THE CONTRIBUTION OF USM COMPANY FINANCIAL DATA TO THE STUDY OF TRADITIONAL MDA PREDICTIVE MODELS

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ABSTRACT

This thesis presents a detailed investigation of predicting of corporate financial failure, using two traditional (Altman and Taffler) Multiple Discriminant Analysis models on companies whose equities are traded on the London Unlisted Securities Market (USM) and on those that have passed or graduated from the USM to a full listing. The primary objective was to see if the two models can be effectively used in the context of the USM to either to predict or at least indicate symptoms of financial collapse. Secondly, ratios were taken for further discriminant analysis to see if better ratios can be identified and predictions developed from one or a group of ratios. In this study consideration also has been given to the limited progress in developing the underlying theory of bankruptcy.

The Altman and Taffler MDA models were tested on the USM data. Their predictions compared favourably with those of a multi-discriminant model that was derived from the USM data. However, it was found that all three models gave mediocre and late predictions of individual company bankruptcy. The research found that MDA analysis of company failure had to be supplemented by a more behavioural and subjective approach to the question of company failure in order to be useful. Even

so, the dissertation is able to end with some useful pointers for future research.

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CHAPTER 1 INTRODUCTION AND OBJECTIVES.

The purpose of this research is to assess whether traditional established Z-score anlysis methodology exemplified by the Altman (1968) and Taffler (1977, 1982) is valid in a distinct identifiable market place; in this case the UK Unlisted Securities Market (USM) in order to:-

i) - ascertain if a reliable classification can be achieved,

ii) - to ascertain if there are distinct individual ratios that discriminate and hence classify companies as potential successes or failures more effectively than the multi-ratio Z-score models that have been developed. In adopting this approach, it will be particularly noted if any of the Beaver (1967) ratios are still effective discriminators.

iii) - to see if there is any evidence of a response to the demand for a more theoretical or conceptual approach.

In adopting this objective, the research is responding in part to Lev's appeal (1974) for a more conceptual approach, and also the views expressed by Marais (1979), Zimmer (1983), and Robertson (1984) on the need for an appropriate underlying theory.

The Basic Hypothesis

It is expected that both the Altman and Taffler models

will correctly classify successful USM companies as being consistently above the bench mark score for success, and likewise the failed (however defined) companies will be below the benchmark score for for failure. It is likely that there will be a large band of companies that are in the Altman "grey area." In performing further discriminant analysis, it is expected that a criteria for success/failure will be identified, which may or may not prove more reliable than the traditional Z-score models.

Definitions

It is first necessary to define Multi-Discriminant Analysis. (MDA) In the context of predicting bankruptcy, this is a statistical technique that identifies a particular linear combination of key ratios which will permit the differentiation between "successful" or "non-failing" companies, and "unsuccessful" or "failed" companies. The approach is to use scores derived by substituting a company's ratios into the combination of ratios. "Failure" or "non-failure" is predicted on the basis of cut off values above which failure is deemed unlikely, and below which failure is almost inevitable. Thus, conclusions may be drawn about the financial health of the company under review, and its possible future. Such analysis discriminates between companies on the road to

success and likely to remain there, and those who are heading for failure. It is advocated that the advantage of such a technique is to predict failure long before the total failure occurs, and as such, permit avoiding action to be taken in time.(Kharbanda and Stallworthy 1985 and Pitt Francis 1982)

The definitions of "Success" and "Failure"

1 Success

In the initial classification of success and failure for this study, there are two tiers of success that can be identified. In the first tier, are those USM companies which have "graduated" from the USM to the full listings. Progression through the listing is perceived as an inherent measure or at least a characteristic of success. As such, the hypothesis will expect that they are consistently above any bench mark of failure. In the second tier are USM companies that making progress, but have remained in the Unlisted Securities Market. It is likely that these will still demonstrate all the characteristics of success, but at a lower level than that of the graduates. It is possible also that their performance may be more erratic.

In the analysis that provides the basis for chapter 8 the basis of the definition for "success" has been altered to include only those companies that have consistent records of growth and profitability. In

adopting this approach, we are responding to the theoretical notions of Robertson (1984) and to the methodology suggested by Lev (1974) i.e. to identify potential inherent characteristics and see if they differ between companies with prospects of long term success and those who in the short term are potential failures.

2 Failure

Companies defined as having failed will be initially identified from KPMG Peat Marwick McLintock USM Survey as those which have had their quotation suspended or cancelled. This is close to the definition used by Booth (1983). However, this category can include suspensions/cancellations for reasons other than financial failure. Thus from this category must be derived companies that have got into receivership or administration. This is in keeping with the definitions of inter alia (citations in Karels and Prakash 1987) Altman (1968, 1973), Taffler and Tishaw (1977), and Taffler (1982). To these definitions must be added a merger under $425 of the Companies Acts 1985 and permission to reorganise. Such inclusions would include reference to the Court quoted by Taffler, and equate with the Chapter XI of Altman, Blum (1974) and Elam (1975). Inevitably, such an approach will create the problem that the as percentage of failures among USM

companies, is very small, the sample will also be very small.

The Choice of the Selection of the USM

The USM has been chosen because:-

(i) Little research has been undertaken on USM companies.

(ii) The nature of the companies will be very different from the traditional manufacturing companies studied by Altman, but nearer perhaps to the wider variety of companies studied by Taffler. This will in part respond to the suggestion of Marais (1979) that Z-score models should be tested in different conditions with different companies and different types of companies. Success in this area will further create a valid response to the criticism that Z-models lack universal applicability.

(iii) USM companies are small by the standards of the 1980s, although of comparable size when measured in historic monetary terms to those selected by Altman. (Chapter 4)

(iv) Although managerial style and structure are beyond the scope of this study, the nature of USM companies is typically that of small closely structured firms, with directors involved in the day to day operations and management process.

(v) While they operate in a wide range of sectors within the listings, they favour certain sectors, and

are often in specialist marketing niches within those sectors.

(vi) Selecting the USM responds to three of the arguments raised by Lev. Primarily, when criticising the prediction claims he suggested "that the failed companies in the samples were, on average younger than nonfailed ones." (p149) The USM is a young market with a large proportion of young companies, and as such will eliminate this particular problem. Secondly, since established ratios will be used, there is less "trial and error" involved in the methodology.

(vii) Finally the USM is a small enough market to take either very large samples or complete populations to avoid any selection bias.

Consequently, in the context of the criteria outlined above, the USM companies will provide a useful out of sample test of established methodology.

Methodology

First of all, in selecting a particular type of company, or listings sector, the pattern established by Thomas and Evanson (1987) who investigated retail pharmacies may be followed. Equally, by taking models developed in the 1960s and early 1970s, it will be possible to see if changes in economic conditions have an impact, and if the changes in economic, political and even organisational environment may effect the predictive value of classic MDA models. This may help

to answer criticisms levelled by Joy and Telleson (1975).

To that end therefore, the approach will be to survey USM companies over the period 1982-1987. This will thus cover the early but not the pioneer years of the USM, through the bullish years prior to both "Big Bang" and the October 1987 crash. Altman and Taffler Z-scores will be calculated for each company for each of the five years, although it is recognised that due to post 1982 entries into the market, and post 1982 acquisitions, not all the companies have the full five years of data. It should be further noted that by adopting this approach, the paired sample technique used by Altman and indeed more recently by Barnes (1990), yet criticised by Lev and others, will not be employed. The reasoning for this lies in the fact that to apply such an approach effectively to the USM would require excluding many of the small sectors where there are either no failures, and/or no companies to effectively make meaningful comparisons. Initially, a population of the graduates will be identified and statistically analysed for the pattern of scores and how effectively they classify corporations. Secondly, the exercise will be repeated taking a sample of USM companies that have not graduated to the full listing. As already indicated, the hypothesis suggests that

these will show Z-scores indicative of long term survival, but are likely to be below those of the graduates who could be perceived as being the "high flyers." Finally, the "failures" however defined will be identified and similarly analysed. In analysing the failures, attention will be paid to the perceived symptoms and possible underlying theory of corporate failure. This will involve looking at the characteristics, measures or events suggested by Zimmer, Robertson and Lau (1986).

Having examining the predictive performance of the established Z-scores, further analysis of selected ratios will be undertaken to see if individual ratios, or groups of ratios can improve the existing traditional methodology. This will highlight the characteristics of the graduates, the sample and those in the failure zone.

On final point needs to be added. Robertson advocated that meaningful predictive analysis should be straightforward and rely on readily available data. In making the analysis, therefore, a strongly pragmatic approach has been adopted.

CHAPTER 2

THE DEVELOPMENT OF THE MULTIVARIATE DISCRIMINATE APPROACH

This chapter and the next two trace the historical development of the Multivariate Discriminate Approach leading to a discussion of the models tested in this thesis. In addition, they will review the literature, and provide a background to the development of the Unlisted Securities Market and hence to the companies that form the subject of this dissertation.

Historical Background

The technique of accounting ratio analysis as a means whereby the potential solvency of a business might be assessed, can be traced back to the post Civil War reconstruction period in the United States. Opportunists were anxious to take advantage of bulk discounts available on a variety of goods and needed short term loans to finance the venture. The finance was granted and the loan was to be repaid after the goods had been sold. The banks who were making the short term loans required a current statement of assets and liabilities to assess the creditworthiness of the applicant. By the 1890s, requests for financial statements by banks from loan applicants had become an accepted custom and there was progress towards a formalisation of the assessment procedure (Dev 1974).

Late in the nineteenth century, a pioneer of financial

statement analysis, J G Cannon, (1899) established three "rules of credit science." These were:-

1 Quick assets only are the basis for loans.

2 Fixed assets are only considered as giving an unknown (assumed unquantifiable) support to the quick assets.

3 The debt limit of the borrower has been exceeded when his liabilities exceed 50% of his quick assets.

It should be emphasised that in these rubrics, quick assets equate with current assets and not just monetary current assets.

It is Cannon's Rule 3 that introduced the idea of the traditional 2:1 ratio, since it was felt that current liabilities should be paid out of current assets. To allow for shrinkage and loss of value in a break up situation, an allowance had to be built in and 50% was generally regarded as sufficient (Wall 1919). Inevitably, while this ratio became the most widely used in assessing solvency, there were voices of dissent. Lincoln (1926) summarised the shortcomings, while at the same time advocating the need for additional ratios, consideration of general business conditions, the nature of the business itself, the character of the management, the age of the business, and even its geographical location. All these, Lincoln argued, could have an influence upon the current ratio. Contemporaneously, however, Wall, along with R W Duning

(1928) had developed and tested seven ratios on 981 financial statements to supplement the classic current 2:1 ratio, and even went on later to formulate a crude index of credit strength using arbitarily assigned weights. While this approach met with much criticism at the time, Dev (1974) argues that it was an important contribution, indeed, "a naive attempt to formulate a multivariate linear discriminant function."

The onset of the depression years of the 1920s and 1930s led researchers to examine the characteristics of failed companies. One such study, by FitzPatrick (1931) took twenty known companies that had failed during the 1920s, and computed 13 different ratios for several years before failure. From the trends inherent in the final two years' ratios, the four "best" ratios were identified. FitzPatrick followed this study up by similar conmparative analysis of successful companies (1932). The details of the inter-war studies are listed in Tab 2.1.(Kumar 1986) It will be noticed that these univariate exercises worked in a common direction, i.e. to identify a ratio or a group of ratios that appeared to indicate that the company under review was likely to collapse and attempt to ascertain how early the collapse could be reliably predicted.

Review of the Inter-war studies

In considering the relevance of these studies to the

contemporary Multi Discriminant Analysis approach, it is worth noting that four ratios are highly ranked

Table 2.1 Summary of Univariate Analysis (Kumar 1986)

Author(s)	Date	No of ratios /firms used	Comments
Smith	1930	24/29	Identified four particularly useful ratios.
FitzPatrick	1931/2	13/20	Favoured **net profit : net worth** as the best indicator.
Ramser/Foster	1931	33/51 (approx)	Successful firms had better ratios than those that failed, but there were contradictions. Seemed to find more good discriminators than other researchers.
Smith & Winakor	1935	21/183	Identified **working capital:total assets** as the best ratio. Winakor also introduced means (μ) of ratios.
Merwin	1942	Many/200	Again rated the **working capital:total assets** as the best ratio.
Tamari	1964	10/28	Post WW2 working in Israel. Favoured three ratios, the **quick or "acid test" ratio, net worth:total liabilities** and **net profit:sales**

across the six studies.

Net worth:fixed assets was ranked second by FitzPatrick in 1931, but is highly regarded in five of the six studies.

Working capital:total assets appears four times, and is regarded as "the best" by Smith and Winakor and Merwin. FitzPatrick's "best" ratio; **net profit:net worth** appears in three studies, although two of them are by Fitzpatrick. Also included on three occasions is **net worth:total liabilities,** ranked third by FitzPatrick. Perhaps the most significant attribute of this ratio is that it is the only one to be included in any of the post-war univariate studies reviewed by Dev. Tamari (1964) includes the ratio in his 1964 Israeli study.

<u>The contribution of W H Beaver</u>

Beaver (1967, 1968) was among the first to focus on the ability of ratios to predict. The perceived over-riding shortcoming of any ratio analysis is that it is based upon historic data and past events. Thus Beaver began to look at the ability of ratios to predict. As a result, the emphasis in his study of ratios was the prediction of important events, one of which was failure. Over the period 1954-64, Beaver analysed 79 firms using the paired sample approach, i.e. taking 79 firms that had not failed and 79 that had failed of similar size from the same industrial sector. Financial data for the five years up to the failure was then analysed using 30 different ratios.

Beaver's results revealed **cashflow/total debt** as the

most reliable discriminating variable. Over the period from five years before failure, surviving companies maintained a consistent average ratio of 0.45:1, while failed firms fell away sharply from 0.15:1 five years before failure, to a negative ratio between two and three years before final collapse. It is, however, noteworthy that Beaver's second choice was **net profit/total assets,** a ratio given the greatest weight by Altman and included by Ramser and Foster in their long list of discrimatory ratios. Beaver found that where this ratio began to deteriorate below a positive figure, failure followed. In this case, Beaver found that the negative ratios began to appear some 3½ years before the final collapse. Beaver's third choice was was **total debt/total assets.** This approach is not dissimilar to Taffler's choice of placing total liabilities over assets. Beaver again found that failed firms revealed a marked increase in debt which occurred three years before failure.

Beaver claimed that his cashflow/total debt ratio was viable for predicting business failure, claiming that it was a reliable indicator some five years before the event. This claim was based upon the smallest percentage error. (Only 10% of firms misclassified one year before failure, and only 22% five years before.)

The development of the MDA approach

The 1960s saw the emergence of the Multi Discriminant Analysis [MDA] approach to financial ratio analysis. Although explained in more detail in chapter 8, discriminant analysis is a statistical technique which derives a mathematical linear function enabling the researcher to classify data by placing it into a particular mutually exclusive group such as a company likely to fail, or enabling the identification of the most powerful discriminating variable(s). In the context of financial analysis, financial ratios are selected to form the basis of the prediction. By using several ratios, any inherent disadvantages arising from using a single ratio in isolation purport to be eliminated. It is the identification of a powerful discriminating ratio(s) that the pre-1939 researchers cited by Dev and Kumar were ostensibly working towards.

The original usage of discriminate analysis dates from the 1930s. R A Fisher first employed the technique in 1936 to solve problems in physical anthropology and biology. ("The Use of Multiple Measurements in Taxonomic Problems" in the Annals of Eugenics. [No 7 September 1936 pp179-188]) Early social science applications appeared in 1954 by Tatsuoka and Tiedman in the context of physiological and educational testing. (Review of Educational Research 24 pp402-420)

Other applications such as in political theory, law and medical research are cited by Klecka (1980).
The initial progress towards employing the methodology in a financial context was made in the field of credit control analysis in the 1940s. The application of such techniques to assess credit worthiness for used car loan applications, was recorded by D D Durand in 1941 and in the context of installment creditworthiness by Myers and Forgy in 1963.

In the realm of corporate financial standing and financial management, J E Walter [1959] used the MDA approach for investment classifications, emphasising the level of Price/Earnings ratio, while K V Smith (1965) used the approach to classify investment securities.

In selecting the variables, certain constraints must be observed.

(i) No variable may be the combination of another variable.

(ii) No two variables that are perfectly correlated may be used simultaneously. These two strictures are result of the mathematical requirements of the technique, but Klecka (1980) argues that they make sense intuitively. Clearly, two variables that were perfectly correlated would either work

together or in opposition when combined. The important feature must be that differing characteristics must be combined together.

(iii) Many applications require that the population covariance matrices are equal. Inevitably populations of failures, as a percentage of the total number of businesses in any form of listing, is likely to be small. As a result, it is unlikely that there will be any significant difference between covariant matrices due to the small sample of failures.

(iv) Each sample group should be drawn from populations that have multivariate normal distributions. This enables the precise computation of tests of significance. However, recent evidence suggests that with dichotomous variables, the methodology is still valid.

In the light of these important comments we can now consider the first Multi-discriminant equation developed by E I Altman.

Altman's Discriminating Analysis

E I Altman (1968) was the pioneer user of multi-discriminant analysis in a financial context. The initial research used MDA to distinguish between bankrupt and nonbankrupt manufacturing firms in the period betwen 1946-1965. As with Beaver, a paired

sample approach was employed, matching 33 bankrupt and 33 nonbankrupt firms on industry and asset size. Asset size was defined as between $1-$25 million. Twenty-two variables were originally selected, measured in the year before bankruptcy, and considered for the discriminate function. The combination finally involving the most significant variables and the estimated discriminate function is:-

$$Z = 0.12X1 + 0.14X2 + 0.33X3 + 0.06X4 + 0.10X5$$

where Z was the weighted average index, indicating the overall health of the company under review and

X1 = working capital/total assets

X2 = retained earnings since inception/total assets

X3 = earnings before taxes and interest/total assets

X4 = market value of equity/book value of total debt

X5 = sales/total assets

The value of Z finally calculated, is expressed as a percentage. In the original work undertaken by Altman, three groups can be identified. In the prediction of bankruptcy, if the value of Z was >2.9 (later modified to 2.7) this implied that failure was unlikely, while if it was <1.8, then failure was certain. In between 1.8 and 2.9 was a grey area, where the outcome was uncertain, but such companies might be suspect.

The ultimate equation is developed from a large number of variables, but only the set of variables that

finally "best" distinguishes or identifies which grouping is appropriate is employed. In adopting that approach, Altman is following the methodology of the pre-war workers.

Review of Altman's ratios

Altman's first ratio, **working capital:total assets** is the second most popular among the pre-war workers. Indeed, two researchers, namely Smith & Winakor (1935) and Merwin (1942) regard it as the "best". Altman then then moves onto **profitability,** deemed to be the most important indicator of health, and hence has the highest weighting. However, amongst the pre-war studies, only Ramser and Foster (1931) regard this as a good discriminator, although in the post-war era, Beaver, (1967) reverting back to single discriminating ratios, ranked it second best.

The three other ratios selected are:

(i) **Retained earnings, or reserves:total assets** is a response to the perennial problem of what Argenti (1976) describes as corporate infant mortality. It also anticipates the Lev (1974) comment about the exclusion of age in any paired sample analysis. Indeed, Lev cites Dun and Bradstreet data which clearly shows an association between youth and failure rate in the post war era. Altman was thus looking for a period of stability in which a

company can build up reserves, and the lack of such reserves is a pointer to an unhappy short-term future. Consequently, this ratio was accorded the second highest weighing after profit. Among the pioneer workers, only the Smith study of 1930 recognises this ratio among four eventually identified.

(ii) **Sales:total assets** is employed in the Ramsey and Forster study's numerous ratios.

(iii) **Market value of equity:Total book value of debt**

The choice of this last ratio is unique to Altman. Although given the least weighting, it indicates the measure of stock market confidence in a corporation, as well as its current level of gearing. This latter attribute arises because the ratio is the reciprocal of one of the gearing ratios. It should, however, be emphasised that it is the book value of debt that is used, and no attempt is made to bring in a market value of debt or to assess the interest cover. It should also be noted that this approach differed from the Beaver 1968 approach, where again market prices were brought in. Altman was bringing confidence into the equation, while Beaver compared market prices with the ratios to see which was more reliable.

Altman claimed a success rate of 95% in the year before

bankruptcy, 72% in the two years prior to bankruptcy, but only 48% in the third year and 36% in the fifth year. However, he did notice that the most serious deterioration in ratios occured between the second and third year prior to collapse. Altman's estimation sample correctly identifed 31 of the 33 bankrupt firms and 32 of the 33 nonbankrupt firms. To validate the equation, Altman also gathered further data on 25 bankrupt firms and 66 nonbankrupt firms in a holdout sample. The model correctly identifed 24 of the 25 bankrupt firms and 52 of the 66 nonbankrupt firms.

The use of a holdout sample is important methodologically. Knowledge of a firm's ratios and whether it went bankrupt or not is used to determine the discriminant function and the "optimal" Z score cutoff for the estimation sample. This uses hindsight. When the function and the "cutoffs" are used on another sample, the hindsight factor is not present and the function may not predict as well. The fact that it did, adds considerable credibility to the function's predictive ability (Gupta, 1983).

One additional comment is merited in respect of Altman's practice of having total assets as the demoninator in four of his five ratios. More recent work, (Sundarsanan & Taffler, 1986) concerned about the

impact of size as a potential for distortion in the analysis, concludes that Total Assets is one of the two most suitable denominators or deflators for this purpose. It is possible Altman considered this when developing his model for proprietary use in the 1970s.

The Problem of an American based model

Altman's initial work was based on American companies and has a perceived inherent American bias. In an attmept to counter this, and in the wake of the Rolls-Royce collapse, the Englishman John Argenti (1983) made some tentative adjustments to the original Altman score to make it more relevant to the UK situation. In the event, Argenti found that Rolls-Royce survived far longer than the ratios suggested, ICI and GEC were were consistently in the "grey" area yet neither have ever been in any sort of financial difficulty, while British Leyland, clearly in trouble, showed a grey ratio of similar proportions. Argenti thus suggested that for British companies, the figures should be >2.0 and <1.5, producing a very much reduced grey area of uncertainty. Inman (1982) similarly tested the unmodified Altman against three collapsed UK companies. (Lesney, Stone-Platt and Dunbee-Marx) The results obtained showed a progressive decline, with a slipping under the 2.9 threshold within two years of collapse. However, no data produced a figure below 1.8. What was

interesting was that Inman found that when the model was tested on non-failed examples, the traditional engineering and electrical manufacturing companies showed scores above 2.9, the overseas trader and hotel and catering sector were consistently below 2.9 and even producing scores below those of the companies tested that had collapsed. This may anticipate the David Pitt Francis (1988) view, that one of the main drawbacks of any Z-score prediction, is that it cannot be universally applied. The best that Inman could conclude was that the scores indicated likely trouble and that urgent management action was needed if long term survival was to be achieved. Thus it could be argued that Altman did not readily predict UK collapses and showed other major UK corporations firms (such as LONRHO) apparently in the "grey" area.

This perceived problem has however remained. Wood and Peisse, 1989) see them as substantial, but not critical. Rather, they argue that the initial Altman model is robust, with few exclusions or exceptions being claimed about its performance. Indeed, it is common to provide Z-scores commercially for single companies, both UK and non-UK based upon the American model. Indeed, commercial users will be more interested in scanning affinity groups rather than randomised samples, it may be argued that an industry

set provides a more realistic test in any event.

Development of Altman's work

Irrespective of the reservations cited above, Altman was aware of any perceived shortcomings. During the 1970s, he made modifications to his formula to improve its accuracy and to widen its appeal.(1977) For private companies, with little or no movement in shares and hence no real market price, book value was used to derive the value of X4 and a discriminate of U.S. private company data produced a set of different weightings:-

$$Z = 0.717X1 + 0.84X2 + 3.107X3 + 0.42X4 + 0.995X5$$

From this formula, the revised cut off points become:-

>2.9 all is likely to be well, while the lower limit of the "at risk" or grey area goes down to >1.2.

Altman also recognised that certain industries are highly sensitive, and as such, the asset turnover fraction was removed. In this case, the resulting revised formula became:-

$$Z = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4$$

and the resulting scores became:-

>2.6 implied safety and unlikely to fail,

<1.1 was the portent of failure.

In the late 1970s, Altman along with Haldeman and Narayanan (1977) developed a proprietary model. This included both small companies i.e. <$25 million asset value, a wider range of manufacturing companies and

also retail organisations. Greater care was taken in developing the model, using bank data on lending losses and lending rates as well as taking into consideration accounting procedural developments, notably the requirement in the United States to capitalise leases. (The FASB's SFAS 13 was issued in November 1976, some considerable time before SSAP21 was introduced in the UK.) The other procedural concessions made to comply with uniformity of presentation were:-

- adding back any contingency provisions (FAS5/SSAP18)
- netting off minority interests into the liabilities
- introducing non-consolidated subsidiaries (i.e those exempt under the rather subjective paragraph 21 of SSAP14 [pre ED48])
- goodwill was written off (SSAP22/ED47)
- R & D was written off (SFAS2/SSAP13)

In addition, there was a greater emphasis in the choice of company, matching for industry and year between success and failure. The final model develops a Zeta-score and uses seven ratios namely:-

- return on total assets
- stability of earnings
- debt service, which is a logarithmic relationship between interest coverage, working capital and total debt. (Such a variable is not linearly dependant on on the others, but it is likely to have a non-normal

distribution.)

- cumulative profitability - retained earnings:total assets
- capitalization - common equity (ordinary shares) to the total capital and is averaged over a five year term. Essentially, this is gearing.
- liquidity - the current ratio
- size of firms based on total tangible assets

This model was called Zeta to distinguish it from the earlier models. It will also be noted that there is a strong trend evident in this formula, responding perhaps to the views expressed in the early 1960s, namely that ratios in a single year were not reliable indicators. The end result was a model that claimed to be substantially more reliable and less erratic than the earlier Z-scores. When tested against the records of 64 companies that had filed for bankruptcy, a 90% accuracy within one year was claimed, and a better than 60% even up to five years. (Table 2.2)

Table 2.2 Comparative percentage error rates
Z versus Zeta

Year from Collapse	Z%	Zeta%
1	5	5
2	28	10
3	52	22
4	71	33
5	64	37

While the improvement and hence apparent better success rate would appear to be impressive, it should not be forgotten that the revised model was developed in a somewhat different economic climate and with possibly different companies. In any case, this model will not be considered in this study, primarily because it is not readily available and secondly, due to the trend element, it does not readily lend itself to companies who have only been in the listings less than 10 years and in many cases even shorter periods.

One final point about the Altman models needs to be made. Johnson (1970) criticised Altman by arguing that the ratios do not predict, but that the two groups of corporations have dissimilar ratios. The corporations that had collapsed had differing values for the chosen ratios from from those that survived. For a ratio to unequivocably predict, the ratio must imply failure or non-failure from certain results.

This criticism may strike at the very basis of the Altman and other methodolgy. For Johnson's view to be valid, it must imply that a ratio can be identified, universally applied and make a clear distinction between survival and failure. That no such approach appears to have been adopted, or even proved to be practical, is, in itself interesting. The Johnson debate does not appear to have

been taken up to any great extent in subsequent literature. However, it provides for a transition point from Altman, who presented a predictive model and Taffler, who will appear more equivocal in his conclusions.

The Taffler Model

In the United Kingdom, a proprietary model has been developed by R J Taffler. This is designed to be more appropriate to the UK commercial environment and to have wider industrial application than that of the American Altman. This was eventually outlined in 1977 and has also become the basis of the PAS-score marketed by Performance Advisory Services Limited.

After testing more than 80 different ratios, the four best discriminators were eventually isolated to give the basic equation:-

$$Z = CO + C1R1 + C2R2 + C3R3 + C4R4$$

From the 1977 model, values can now be put to the coefficients C1-4 and the result is:-

$$Z = CO + 0.53R1 + 0.13R2 + 0.18R3 + 0.16R4$$

where:-

R1 = Profit before taxation/Current liabilities

R2 = Current assets/Total liabilities i.e total debt

R3 = Current liabilities/Total assets

R4 is described as the "No credit interval" and is defined as:- $\frac{\text{Immediate assets - Current liabilities}}{\text{Operating costs - Depreciation}}$

R1 rightly concentrates on the ability to generate profit as a potential for generating cash to pay liabilities. In this, the Beaver/Blum approach is satisfied, in that the cash "reservoir" is being filled. Equally, where the loss exceeds the current liabilites, the strain on the reservoir is emphasised. However, the choice of a ratio of profit to current liabilities is a departure from the traditional thinking of the earlier univariate ratios.

R2 is an extension of the traditional current asset ratio. Although asset backing is considered important, the model may suffer from the almost traditional "blinkered" outlook that the current ratio must be 2:1. This belief is emphasised when it is recalled that the original basis of the 2:1 was a procedure that put greater emphasis on current assets rather than any fixed asset collateral. Since contemporary UK clearing banking procedures tend to favour fixed assets as primary collateral, and the current ratio found little favour among the pre-war workers, this may be an inherent drawback within the model.

R3 likewise looks at asset cover and perhaps considers the "over trading" syndrome where fixed assets are being financed out of current liabilities, usually

demonstrated by a persistently high overdraft, well up to the limit, and a high creditor level, well out of line with what might be expected for the industry under review. However, it can have the effect of countering any adverse indications highlighted by R2.

R4, by introducing net immediate assets considers the amount by which monetary working capital i.e. debtors and cash exceed current liabilities. In adopting this approach, the quick asset ratio is emulated. However, while this provides a valuable indicator as to just how quickly the organisation can pay pressing creditors and develops the reservoir idea still further, where there is a high cost/low margin or loss situation, the impact of the negative numerator is substantially reduced by the large denominator.

The constant CO was not included in the 1977 discourse, and has yet to permeate the literature. (e.g. Braganza 1989) However, since a constant only moves the axis, it does not influence the interpretation in the slightest way. As such, therefore it can be ignored.(Wood and Piesse 1989)

None of the Taffler ratios can be recognised in the "best discriminators table" drawn up by Dev (1974). Also R1 and R4 are ratios that divided flows by stocks and vice-versa, so that the numerator and denominator have inconsistent dimensions. Conversely, however, it may be

argued that the unconventional nature of the formula tends to answer the inherent problem emphasised by Tamari, namely that of window dressing. Additionally, it must also be emphasised that Taffler does not regard the model as a tool for predicting failure per se. Rather, if a company has a low score, (<0.2 is quoted in the 1982 paper) it is exhibiting characteristics of companies that have historically failed. In adopting this position, Taffler is thus closer to the views expressed by Johnson, that failed corporations have ratios with different values from those which are perceived successful, and as such, any company exhibiting such ratio values could be deemed to be in likely danger of short term failure.

Conversely, a positive score (and certainly >0.2) is indicative of survival. With the element of overlap, and evidence from the research reported below, (Chapter 5) the nearest Taffler comes to an Altman-style "grey area" is where the score is between 0 and 0.3.

It is worth adding, from a methodological viewpoint, that Taffler's prediliction for cash based and perhaps unconventional ratios, largely excludes any of the identified "size deflators" that have concerned other later researchers, including Taffler himself.

Criticisms of the Z-score Approach

Almost inevitiably, a substantial number of criticisms

have been voiced about the operational shortcomings of Z-score analysis. These criticisms appear to fall into three broad categories:-

(i) The lack of underlying theory

(ii) The lack of information

(iii) Are Z-scores any more reliable?

<u>(i) The Lack of Underlying Theory</u>

This is perhaps where the most serious concern has been expressed about the lack of any theory about bankruptcy or company failure of any kind. Gambling (1985) describes the Z-score approach as being rather like a declaration that the cause of death is dying. By contrast, a more operational view was expressed by Pitt Francis (1988) who emphasised the lack of universal definitions causing a blurring of the distinction between short term and long term creditors and the problem of general applicability. In part, this point may have been answered by Lau (1986), who brings into her calculations the possibility of ratios being out of step with the industry sector under review.(Chapter 3)

This point about definitions can be dramatically observed when comparing Altman and Beaver. Of Beaver's 79 companies, only 56 were actually bankrupt, the others having failed to pay preference dividend or defaulted on loans while one had serious overdraft problems. By contrast, Altman selected only firms that

were legally bankrupt, in receivership or had the right to reorganize under Chapter XI of the National Bankruptcy Act.

Lev (1974) argues that lacking such theory, there is a tendency for researchers to adopt a trial and error, intuitive and data-availability orientated approach (Watts and Zimmerman 1986). The results are thus often inconsistent and any attempt at generalisation becomes impossible. Secondly, Lev points out that since the studies are retrospective, (i.e. after the failure event,) the sample selection tends to be biased. He also suggests that the failed companies were of different ages to the non-failed. It is likely that the failed companies are younger. This study, by focussing on the youthful companies of the USM, may in part answer that difficulty. Lev is also critical of the paired sample approach and even suggests that non-accounting data should be included, citing by way of example, the Beaver (1968) attempt to introduce market prices.

Lev suggests that prospective analysis may be the way forward. This would involve an <u>a priori</u> knowledge of the characteristics of failure, then taking a random sample of firms using the performance over time to detect associations between economic characteristics

and the causes of failure.

The nearest to any form of theory as such, has come from Robertson (1983). In developing his own Z-score (infra Chapter 3) he has identified four key elements in company failure. These are trading stability, declining profits, declining working capital, and increase in borrowings. In many respects these are similar to the components identified by the banking orientated LENS study of Zimmer (1980) and Houghton (1984) and tested statistically by Houghton and Woodliff (1987). Like Robertson, the emphasis was upon:-

Profitability measured by $\frac{\text{Profit before Tax}}{\text{Total Assets}}$ (c/f Altman);

Liquidity measured by the Quick or Acid Test Ratio;

Dividend policy measured by the reciprocal of dividend cover i.e. $\frac{\text{Ordinary Dividend}}{\text{Ordinary Earnings}}$ (c/f Lau and Gentry et al);

Cashflow generation measured by the reciprocal of Beaver's highly acclaimed ratio, i.e $\frac{\text{Total Debt}}{\text{Cashflow}}$;

Gearing measured by $\frac{\text{Long Term Debt}}{\text{Shareholders' Equity}}$.

Clearly the profit and gearing ratios respond to Robertson's view, and the addition of the liquidity ratio partly impinges upon the third component viz., the impact of declining working capital. Essentially, if any model

development or "best ratio" is to be considered, then it is well to test existing models against the Robertson criteria.

Trading stability

Altman considers trading stability in the context of his sales:total assets ratio. As the market share is lost, so this ratio will slow down, because stock is not being shifted. The ratio could be exacerbated further by increased debtors, since a failing company, conscious of loss of market share may adopt a policy of "sales at any price", the price being increased credit,(C/f Tamari). Taffler does not bring sales into his model, although both the Tamari (1964) and Edminster (1972) models contain sales based ratios.

Declining profits

Inevitably, the ability to generate profit is vital to long term survival. In satisfying this criterion, Altman considers not just the annual ability to generate profit but the impact of retained profits in the form of reserves. Taffler considers profit in the context of the ability to generate profit to ensure that liquidity is sustained. Both researchers give the profit based ratio the highest weighting.

Declining working capital

Robertson argues that declining profits will lead to a declining working capital, exacerbated if a loss

situation develops. He also emphasises the impact of expansion of fixed assets at the expense of working capital. Altman partially satisfies this criterion by using gross working capital:total assets. Clearly, if this ratio declines, then the resultant Z-score will decline and as such, it is certainly indicative of a trend towards failure. Taffler is probably closer to what Robertson envisages, in that he considers working capital in three of his ratios. First, he considers the ability of the current assets to cover the total liabilities, and if this ratio declines, then the trend will be towards failure characteristics. Secondly, there is the current liabilities:total assets ratio, which could also move adversely if there is over investment in fixed assets, or there is increased working capital from slow moving stocks or slow paying debtors. This ratio also would be affected by the Tamari view that in the context of possible failure, credit lines from suppliers get cut off. The third use of a working capital based ratio is in the no-credit interval, which if negative, will cause a deterioration in the score, but the full impact of this deterioration is lost if cost structures in relation to profits and losses are high. In this context, the Taffler ratios all tend to lack an obvious independence, especially since current liabilities is used both as a

numerator and a denominator in the formula.

It should be noted that Tamari (1978) makes an important comment in regard to working capital ratios, something that Robertson curiously appears to ignor. Tamari accepts that a declining working capital situation manifesting itself in a hand to mouth operation, struggling from day to day is symptomatic of an "at risk" or failing company. However, he also envisages a situation where deteriorating stock turnover ratios are compensated by increasing debtors turnover which, coupled to a reduced level of current liabilities would actually increase the working capital however defined. Nonetheless, whatever the shortcomings may be inherent in working capital based ratios, they find considerable support among other workers such as Blum (1969,1974) who favours working capital:total assets in the same way as Altman and Edminster (1972) who employed working capital:sales.

Increase in borrowings

Robertson sees increased gearing as a means whereby profit will be further reduced by increased interest charged. In this context, Altman considers total debt, controversially in the context of market value, or later in the context of total book value. Clearly, the emphasis is on security and the ability to sustain debt. However, Altman gives the ratio the lowest weighting.

Taffler only brings gearing into the total liabilities ratio, anxious to see if these liabilities are less than the total gross working capital. This again harks back to the original American banking view of allowing debt up to one half of the gross working capital only.

While it may be debated that Robertson has not formulated any theory of prediction, he has at least suggested possible criteria along which any MDA model may be provisionally developed, although the following points should be noted.

Few writers seem to favour sales based ratios, and it remains to be seen if such ratios are effective discriminators. One obvious limitation is the extent to which any product is sensitive to industrial trends and the economic climate. Clearly, the ability to generate profits, increase corporate wealth and pay debts when they become due must remain at the centre of any future development of predictive models. Working capital is subject to the constraints indicated by Tamari, but remains a popular ratio. Impact of increased borrowing, like sales, may reflect the business sector or the current cost of capital.

<u>(ii) Z-scores are based on hindsight</u>

In the forefront of this line of criticism is Ohlson (1980). More recently, this view has been supported by Wood and Piesse (1987, 1989). Ohlson is basically

critical of the over-estimation of the predictive reliability of the Z-score figure, especially when collapse is coming close. The last accounts are often late, and are filed much less than a year before the failure. This is the essence of the Wood and Piesse argument, in that the accuracy measures claimed for the Z-score models are based on ex post outcomes i.e. known data and as such, the accuracy is artificial and subjective and of questionable information value. By contrast, Ohlson's criticism argues that there must be the same number of companies in the analysis. This approach is the basis of the paired sample analysis used by Altman and others but is criticised by Lev. Reality is that the MDA approach remains valid in the absence of paired samples.

(iii) Z-score superiority

The original historical research developed a use of a number of ratios because it was considered that one single ratio was restrictive and potentially misleading. Collections or combinations of ratios purport to improve the accuracy of ratio prediction. There is, however, increasing evidence that this is not the case. Gupta (1983) made a systematic comparison of Altman and Beaver and found that Beaver's method was definitely more reliable than that of Altman. The results over a five year period are summarised in Table 2.3.

Table 2.3 Beaver versus Altman
Percentage error in Prediction

Years before collapse	Researcher: Beaver %	Altman %
1	13	5
2	21	28
3	23	52
4	24	71
5	22	64

Clearly, Ohlson's criticism notwithstanding, Altman is ostensibly more accurate in the final years, the Beaver approach gives a less erratic and possibly more reliable long term warning. In addition, Wood and Peisse have compared Altman single ratios and found that the combined Z-score is no better a predictor than the single ratio. A further critical approach in this area has come from research that has compared financial market assessment with accounting Z-score models. Here the conclusion has been that the models do not outpredict the market. (Westerfield 1970; Aharony, Jones and Swary 1980)

Concluding Remarks

From this historical review, it is apparent that the methodology has developed purely on a needs basis using empirical evidence. Apart from the tentative efforts by Robertson, there has been little attempt to answer Lev's plea for a theoretical basis. Rather, the pattern has been one of trial and error, ratios being selected

because they served the purpose required. The pattern seems to be that first individual ratios have been identified, then to counter the inherent danger of a single ratio, groups of ratios selected. This has been followed by combining ratios, and finding an acceptable combination.

Once found, the combination itself has been subject to a variety of tinkering exercises, to suit individual industry groups, corporate size and possible national characteristics. The over-riding problem does not appear to have been satisfactorily answered, that of the fact that this is all based upon past events, and as information in its truest form, has limited value. Cognizant of these limitations and doubts, this dissertation will evaluate the two major models and then the individual ratios will be tested, to see which are the most reliable.

CHAPTER 3 LITERATURE SURVEY

The purpose of this chapter is to review the main contributions to the literature on discriminant analysis in the financial field. The emphasis is upon the authors other than Altman, Taffler and Beaver, whose writings are of particular relevance to the study. Nine major research papers will be considered, beginning with Blum. This will be followed by a consideration of the behavioural approach, centred mainly on the findings of John Argenti.

1 Blum

Blum (1969, 1974) developed a "failure-prediction" model based on accounting and share price data. Blum advocated that a prediction model must have a theoretical basis and is critical of Altman for his lack of such a basis. However, despite the criticisms raised by Lev (1974), he used MDA and paired samples, computing ratios for 115 companies. Blum's results claimed that his model correctly classified potential

Table 3.1 Major Pioneer Researchers using Mulitvariate Analysis

Author	Altman	Taffler	Beaver	Blum	Tamari
Year	1968	1977	1966/8	1969	1964
No of ratios evaluated	22	80	30	12	10
No of companies	33		79	115	28
Years under review	1946-55		54-64	54-68	58-60
Country studied	USA	UK	USA	USA	Israel

Table 3.2 Ratios shown to be good discriminators in Multivariate studies

	Altman	Taffler	Beaver	Blum	Tamari
Current ratios					V
Current assets: Total liabilities		V			
Net quick assets: stock*				V	
Current liabilities:total assets		V			
Capital structure					
Net worth:total assets			V3rd		
:liabilities					V
Reserves:Assets	V				
Market value:Total liabilities	V				
Asset structure					
Working capital: total assets	V			V	
PBIT:total assets	V		V2nd		
Profit:Sales					V
PBIT:Current liabilities		V			
Return on equity				V	
Sales/Costs					
Sales:Total assets	V				
Sales:Debtors					V
Value of prod:stock					V
Value of prod:Wcap					V
No credit interval		V			
Cashflow:Total debt			V1st	V	

failures with an accuracy level of 93-95% within a year, 80% within two years, and 70% prior to that. However, Blum also compared his Failing Company model against Beaver's single ratio, and found surprisingly little improvement. The ratios that Blum selected are listed above in Table 3.2 which also shows the ratios used by Altman (1968) and Taffler (1977) together with the ratios Beaver found to be the most consistent

predictors on their own. In addition to the single ratio, Blum also placed emphasis upon a "trend break", i.e. where a variable has a less favourable performance than in a previous year - identifying a pattern of ratio deterioration.

Blum has the same perception of the firm as Beaver, i.e. a reservoir of assets supplied by inflows and drained by outflows. Solvency and ultimately survival, depend upon the probability that this reservoir will continue to be supplied. Thus, Blum agrees with Beaver about cash flow, reinforced by measures of liquidity, asset resources and the ability to generate profit. It is noteworthy, however, that despite making some attempts at moving towards a theoretical base, Blum does not appear to either anticipate or answer any of Lev's criticisms of the MDA methodology.

2 Tamari

A second researcher at this time was the Israeli economist, Tamari. In his initial research he compared ten ratios calculated from the accounts of 28 Israeli industrial companies which had either been declared bankrupt, or had been given consolidation loans or granted a moratorium, but were, in effect virtually bankrupt. Although this definition is close to that of Altman, it is a move away from the strict definition quoted by Dev (p61) i.e. "inability to pay its obligations as they fall due." From his analysis which

he called an Index of Risk, Tamari identified:-

- three ratios that exhibited the most marked adverse trends, (Table 3.2)
- ratios which when compared were markedly worse than those of the particular industrial sector,
- and that a large proportion of companies have at least one weak ratio thus concluding that the analyst cannot rely on one single ratio in measuring the degree of risk. By adopting this stance, Tamari is immediately perceived as being at odds with Beaver.

Tamari's best three univariate discrimators are interesting in themselves. In identifying **net profit:sales**, he agrees with Ramser and Foster in seeing the importance of healthy margins. However, in identifying the **quick or acid test ratio**, he has selected FitzPatrick's "4th best". In addition, his third ratio, **net worth:total liabilities** is joint third in popularity among the pre-war univariate discriminators, as well as being FitzPatrick's "3rd best".

From the univariate study, Tamari went on to develop a risk index by assigning weights to discriminate between successful companies and failures. This was fairly successful in discriminating between companies that subsequently failed within the period studied and those that did not. He emphasised that the index was not

built on the basis of actual data building up to an equation, (such as Altman's) but rather on subjective and theoretical considerations which, it was suggested, would make the index more applicable to different sample firms. The ultimate rankings and weights allocated to the ratios selected, were derived from extensive interviews with credit managers and financial analysts in Israel and the United States as to which ratios had proved most valuable in indicating ultimate failure.

Although six ratios appear in his Index of Risk, three ratios are considered the most important, and are given 70% of the weightings. These are:-

Equity and capital reserves:Total capital,

Profit:sales - but with an emphasis on consistency of performance over a three year period,

Current ratio

The equity ratio was considered to be an important indicator. A low ratio, especially where there is low investment by the owners was indicative of a potential failure and a possible large loss. The trend element was introduced into the profit ratio to eliminate the potential distortion inherent in an isolated large loss at a point in time. To further dampen down any further potentially misleading aspects of over-emphasis on profits before tax in isolation, consideration was

given to trends in value of production. This in turn would give an indication as to the size of the firm and whether unsold stocks were accumulating.

Both Altman and Beaver found that the traditional current ratio had little to contribute to the predictive power of financial ratios, although others, for example, Horrigan (1956) and Foulke (1986) suggest that it is a good indicator of short term solvency. (This may well have influenced the American banks in the early years of ratio analysis.) Tamari nonetheless retained the ratio, fully aware of the obvious inherent defect, i.e.:-

- assets actually increasing because of unsold inventories or uncollectible debtors compared with reduced creditors because of credit rejection.

Irrespective of this apparant distortion, the fact remains that a ratio of less than 1:1 still means that a company is unable to meet its current obligations without selling fixed or long term assets. In such a situation, a firm can be regarded as financially bankrupt, even if not legally or factually.

In defence of Tamari's seemingly almost obstinate stand, Lev cites Altman in emphasising that the most successful prediction equation takes into account the <u>interactions</u> among the variables, and the variables

themselves are not always the most significant when utilised individually. Tamari also emphasised that that none of these ratios are linked in anyway to the industrial sector in which the company operates. High gearing, consistent losses and poor liquidity all point towards inevitable failure. The three other ratios, which require reference to the sector are:-

Value of production/inventory

Sales/Trade debtors

Value of production/working capital

Tamari later collaborated with Parosh to develop a statistical model based on regression analysis (1977). This approach was favoured in preference to an MDA-based model because of alleged greater ease of availability, greater suitability for use with unquoted companies and it required no reference to industrial sub-sector or size of firm. This latter attribute, made the resultant model more useful in economies where sector data and credit worthiness information is not readily available.

The results obtained based on the regression analysis based on empirical research on a population of large Israeli manaufacturing firms, and containing a batch of 33 companies that ultimately failed was:-

$$Y = 0.43 + 2.204X1 - 0.2X2 + 0.371X3 - 0.078X4 + 0.204X5$$

where Y = 1 for firms which ultimately failed in the

late 1960s and

Y = 0 where they did not.

and X1 = profit status 1 for losses in the year 1964
0 for profit in the same year

X2 = equity/total assets

X3 = profit trend 1 where losses increased or profit/equity declined relative to previous years, 0 where the profit or the profit/equity ratio rose

X4 = current ratio

X5 = inventory/sales ratio

The value of R squared was 0.481.

The use of a profit trend reinforced an earlier study quoted in the 1978 text where it was found to be more meaningful. This anticipates the Robertson approach of nearly two decades later. It also reinforced Beaver's view.

The research endorsed the view held by both Altman and Beaver that the current ratio did not give much indication as to the future longevity. This is because, as collapse approaches, unsold inventory levels may increase and debtors likewise increase, reflecting either a "sales at any cost" policy or a reluctance of debtors to pay up, having heard of the company's situation. At the same time, it is likely that current liabilities will go down as the company has greater difficulty in finding suppliers who will give credit. Such a situation would reduce the potential for

liquidity based ratios such as the traditional current ratio and the quick or acid test ratio to effectively discriminate between potentially successful companies and those that are likely to fail.

The approach was found to be a reliable indicator of both potential failure and success. However, to reinforce the validity of this model it was further tested over a period from 1968-1972. The notable difference was that while the first research had been undertaken during the period of recession and war, the the post 1968 period was a time of economic growth. The result suggested that the approach was valid irrespective of population and economic conditions. In adopting this approach, favoured by Watts and Zimmerman, Tamari may have been anticipating the criticisms raised later by Richardson and Davison.[1983]

3 Robertson

Although discussed earlier in the context of some attempts at conceptualisation, we now review this recently developed UK approach of John Robertson (1983). Like Altman, Robertson has developed an empirically-based multivariate analysis model. However, in an attempt to be different, the conclusions are based on the rapidity of change, with a perceived bias towards the future, rather than the score per se. In

essence, this approach is akin to the trend-approach favoured by Tamari, and the continuum approach (Lau infra). Robertson is also critical of the many earlier approaches, arguing that in many cases, the formulae are based on fairly traditional ratios. (c/f Watts and Zimmerman above.)

The ratios Robertson finally selected were:-

$$\frac{\text{Sales - Total assets}}{\text{Sales}} \times 0.3$$

$$\frac{\text{Profit before tax}}{\text{Total assets}} \times 3.0$$

$$\frac{\text{Current assets - total debt}}{\text{Current liabilities}} \times 0.6$$

$$\frac{\text{Equity - Total borrowings}}{\text{Total debt}} \times 0.3$$

$$\frac{\text{Liquid assets - Bank overdraft}}{\text{Creditors}} \times 0.3$$

Following the Tamari approach, Robertson monitors the trend of the total score, looking particularly at large changes in excess of 20%. As an early warning of collapse, Robertson claims from his research, that the first major deterioration could have been as early as five years before collapse. The in-sample results of his study using 48 companies of varying categories and size, but excluding specialised finance institutions and property companies, are shown in Table 3.3.

Robertson thus argues that 87% of the in-sample companies he surveyed, had warnings at least two years

Table 3.3 Summary of Robertson's Results (1983)

Year before failure	Deterioration of Total Score (Greater than 30% for the first time.)
5	18%
4	20
3	22
2	27
1	13

before the final collapse. However, he does not appear to have performed any out-of-sample tests, as performed by Tamari and advocated by Watts and Zimmerman.

4 Edminster

One of the criticisms levelled at the models developed in the 1960s, was that the firms were perceived as large and usually listed on some Stock Exchange. As a result, the potential for use among small and possibly unlisted companies was limited. Since many failures occur among the small developing companies this was a serious defect (Argenti and Infant Mortality 1976). Although Altman himself ultimately addressed this problem by developing a modified Z-score procedure, (supra) Edminster developed a model aimed specifically at small businesses in 1972. It is important that it is considered in the context of this thesis since USM companies are "small" by contemporary standards.

Edminster's study of small US businesses defined a "small business" as one which had taken out a loan from

the Small Business Administration. 42 loss borrowers (failures) were compared with 42 non-loss borrowers over the period 1954-1969. Edminster used 19 ratios, some of which had already been proved before. He eventually produced a Z-score formula based on seven ratios, although it is noteworthy that none of the ratios selected were chosen by other contemporary workers in the field (Dev p71).

The formula is:-

$$Z = 0.951 - 0.423X1 - 0.293X2 - 0.483X3 + 0.277X4 - 0.452X5 - 0.352X6 - 0.924X7$$

where the variables used are non-linear integer mappings onto [0,1] of the following ratios:-

Cashflow:Current Liabilities --> X1

Equity:Sales --> X2

Net Working Capital:Sales --> X3

Current Liabilities:Equity --> X4

Inventory:Sales --> X5

Quick ratio/Industry Average Quick Ratio --> X6

Quick ratio/Industry Average Quick Ratio --> X7

The raw data i.e. the financial figures are not inserted into the model as such. Rather, four ratios (X3 - X7) are compared with industry average ratios, and if less than the appropriate sector bench mark, is valued as 1, otherwise it is zero. X7 is taken as 1 if the quick ratio:sector quick ratio shows an upward trend, otherwise it is zero. Finally, ratio X1 is taken

as 1 only if its ratio value is <0.05 and if X2 is <0.07 then it is taken as 1, otherwise it is assigned the value of zero. Using a cut-off of 0.53 (below which failure was certain) a 93% accuracy rate was claimed.

The use of data transformation in the formula is complicated to apply and may even appear rather subjective and even spuriously accurate. It would thus be subject to severe criticism from Robertson who argues that any formula should be easy to apply. However, the level of accuracy is quite good and the technique does attempt to alleviate the problems of a wide scatter of ratios inherent with small companies.

Altman (1983), commenting on this particular prediction model, notes that whereas other models developed for the larger companies, can give an indication based upon one year's published accounts, this particular technique demanded three consecutive yearly statements for an effective analysis.

Like Altman, Edminster came up with three categories. What he called "white" equates to Altmans >2.9, and as such was a good loan risk. "Black" was a business that had been rejected on the grounds that the risk of failure was too high. In between came "grey" where further investigation might be neccessary.

Despite being frequently quoted in the literature,

Edminster's model has gained little acceptability even with the Small Business Administration. (Kharbanda and Stallworthy p125)

5 Lau's Contimuum Approach

A more recent approach, argued as an extension of the traditional methods of Altman, Beaver and Ohlson is advocated by Lau (1987). Instead of the conventional failed/non-failed dichotomy, financial states are identified, and the model evaluates the probability of entering one of these financial states. The financial states comprise a fivefold continuum along which a firm may move:-

0 - financial stability - the company is ostensibly healthy

1 - omission of dividends - an possible early indicator of deterioration.

(N B This has been defined elsewhere as a distinct indicator of a deterioration in financial health by Gentry et al (1985, 1987) and essentially, Lau is developing their earlier views.)

2 - default on loan payments - this may be in line with the Dev definition of failure, but may perhaps relate to a request for time.

3 - Chapter X/XI filing under US Bankruptcy Legislation. Since there is no equivalent UK legislation this has little value in the UK. Possibly the nearest equivalent is the reorganisation of a company, whereby arrangements

are made for the company to reform itself and to survive with new management and funding.

4 - Bankruptcy, attempts to formulate a successful rescue package or survival strategy under Chapter X/XI having failed.

Both 1 and 2 above are consistent with Beaver's very wide definition of failure.

One obvious drawback with the Lau approach, is that it is failure orientated, having no winner criteria. A successful or surviving company would be presumed to remain at point 0. A further limitation within the UK, comes from legislation about distributable profits. The need to comply with CA1985 and SSAP8 plus the impact of non-recoverable Advanced Corporation Tax would influence the decision to pay a dividend.

In arriving at her continuum, Lau uses a number of mixed variables, i.e. trends, single figures and ratios listed under three headings. Under the first, **financial flexibility,** are:-

X1 - restrictive loans and rates

X2 - debt equity ratios that are <u>possibly</u> out of step with the industry (My italics) (C/f Tamari and Edminster)

X3 - working capital:debt (C/f Taffler)

X4 - share price trend (C/f Altman)

X5 - operating expenses (C/f Taffler)

X6 - payment of dividend - trend in dividend payments

X7 - liquidity (Tamari)

Secondly, under the heading **trends** come:-

X8 - Capital expenditure (C/f Tamari)

X9 - Working capital (Altman and Blum)

Thirdly under the heading **current financial state** comes

X10 - omission of dividend

Both X7 and X10 represent what Gentry et al (1985, 1987) described as funds flow components, corporate long term viability depending upon funds available to cover a dividend, circulation of receivables and money being invested in the business to build it up.

The ratios are then used to calulate probabilities of being in one particular stage of the continuum and the likelyhood of moving into the next one. Using logit analysis, the final formula developed was:-

$Z = bj1x1 + bj2x2.....bj10x10$

where bj represents the coefficients and probalistic scoring from 0 to 4, and the values of x1...x10 the ratios cited above.

As an indicator of financial failure, Lau claims a success rate better than those of Altman (1968 and 1977) Beaver and Ohlson. However, it would appear to be a somewhat longwinded approach, which mixes trends in ratios with trends in other variables, with only marginal increases in prediction accuracy over simpler models. Further, although it appears to present a

progressive grey area, in the light of views expressed by Watts and Zimmerman, the time scale may be very short, and companies move so rapidly along the continuum, that the outcome may appear all too obvious. The real value of this piece of research is the inclusion of the dividend component, which provides an extra criterion when evaluating the characteristics of failing firms.

6 The Bank of England/Marais Model

The Bank of England has developed its own model which is based on the model developed by Marais (1979) and it takes the form of:

$$Z = b0 + b1X1 + b2X2 + b3X3 + b4X4$$

where X1 = current assets:total gross asset (Altman)

X2 = reciprocal of gross total assets

X3 = cash flow:current liabilities (C/f Blum)

X4 = funds generated from operations:net increase in working capital to total debts

bj = regression weights

The model was developed from 38 failed companies and 53 non-failed listed companies. This approach partially answers Lev's criticism that there is no apparent practical reason why the control group cannot be much larger than the failed sample. Indeed, the main advantage of such a large control group will be the decrease in sampling errors of the estimates of solvent firms economic characteristics, and hence an

improvement in the reliability of the results. Over a three year period it was found to be more accurate than earlier models. The results were then verified using 10 more failed companies and 19 non-failed companies. This complied with the Watts and Zimmerman view of methodology. Although the Bank admits to be reasonably satisfied with the working of its model, it emphasises that:-

(1) Any model is subject to accounting procedures inherent in a company or industry. The Bank noted that it was particulary unsuitable for:-

(i) shipping companies who have special provisions under CA1985,

(ii) contracting companies who might have special problems in complying with accounting standards,

(iii) unlisted companies who would not make available all the information required of listed companies. On the latter point, such an admission may enhance the validity of the improved Altman small company score and the more complicated model of Edminster.

(2) More important however, is that the score is derived from the latest data of a company. Z-scores cannot be readily calculated from published interim statements, so source data has to be derived from the annual accounts. This means that the data may be at least four months old, and if there are problems,

likely to be late anyway. (Watts and Zimmerman 1986)

The advantage perceived by the Bank is that it is a starting point for further analysis, especially where there is a falling trend in the Z-score.(C/f Robertson) Falling trends almost inevitably indicated a impending collapse. Again, this is also close to Taffler's view, that the final score from the ratios indicates that the company exhibits certain characteristics, and if the score is low; those exhibited characteristics are of companies that have failed in the past.

7 Ohlson

In 1980, Ohlson published a paper in which he based on corporate financial data from the 1970s. This study identified four major features in affecting the probability of failure:-

i the size of the company (just starting up and hence small - USM companies are likely to be of similar size)

ii the measures of financial structure (C/f Robertson on change of gearing, but there are USM companies that are highly geared.)

iii measures of performance

iv measures of current liquidity.(Still deemed important despite misgivings and potential inherent drawbacks.)

Ohlson was critical of earlier studies because they assumed that the final statements for the year of collapse are disclosed before filing for bankruptcy. Reality, he argues, is often the reverse. Indeed, the

accounts are often late, and bankruptcy may already be inevitable by the time the results are declared, and the very lateness is in itself a characteristic of impending doom. Thus this erroneous assumption causes the overstatment of the model's forecasting ability.

Methodologically, Ohlson uses financial data from firms 10-K SEC reports, because he can determine when these reports are likely to be available. Data availability is important to Ohlson, reinforcing the view that models must be able to work on data such as the Hambro Guide that is relatively cheap and readily available. In the final Logit-based model, nine variables were eventually used and no new or exotic ratios developed. Like Altman, he selected **working capital:total assets,** and **net income (profit):total assets.** In addition, elements of change and trends are also introduced. (C/f Tamari and Robertson) For the sample, he took 2058 non-failed firms from the Compustat file and a bankrupt sample of 105. This not only academically responds to Lev's view, but also relates the proportions of companies vis-a-vis success and failure. An obvious inherent difficulty in any analysis of bankrupt firms is that there are so few of them in comparison to the total commercial population. This problem is exacerbated as the firms progress and become larger.

Ohlson did not find that his model improved the accuracy of prediction. Rather he concluded that more factors may be required if substantial improvements in classification were to be achieved. This in turn would create a far more complicated model including non-accounting factors and based on the procedure suggested by Neter (1966).

It would seem from Ohlson and the Bank of England experience, that there may be an optimum whereby the marginal cost of improving the model to obtain more reliable results is not justified due to the increased complexity. The Bank's pragmatic view that such models are, at best, initial indicators, coupled to the view that companies with low Z-scores exhibit the characteristics of companies that have collapsed before, would seem to be the guiding rubric.

8 Bar-niv and Raveh(1989)

This study presents a new approach to the prediction of financial distress. The authors criticise MDA and other techniques because they are an adaptation of models developed and used for other purposes and can be perceived as lacking robustness. Much of the problem seems to stem from a non-normality of initial data. Their response has been to develop a continuous scoring system based upon a nonparametric model which they have tested empirically across differing US industry

groupings. The paper reports on the testing of the methodology of approach, but does not attempt to finally produce the most accurate and efficient definitive model. The main advantage derived from this approach is a reduction in misclassifications arising from overlap - the area where non-failures are classed as failures and vice versa. Another point advocated was that other variables may prove more effective in classifying companies. This in part answers Taffler, who was conscious of "conventional" or "traditional" ratios being vulnerable to manipulation, and the true situation and hence score being obscured. In testing the approach, much of the data used was supplied by Altman. A number of variables were tested, with eventually 10 being selected. It is not surprising that a marked similarity with Altman's original ratios can be seen.

The ratios were:-

X1 = Net income/Total assets (Altman)

X9 = Current Assets/Total Assets (Altman)

X16 = Log(Total Assets)

X17 = Market Value of Equity/Total Capitalisation

X17 is similar to Altman's ratio that also uses Market Value.

These four ratios were considered the most important. In addition there were,

X3 = Current assets/Total Assets (Altman)

X6 = Cashflow/total debt (Beaver & Blum)

X2 = Quick assets/Total assets (Taffler)

X10 = Quick Assets/Total liabilities (Taffler)

X14 = EBIT/total assets (Altman)

X20 = log(Interest Coverage + 15)

The writers claim a similar success rate in the year before bankruptcy but an improved performance three years before the collapse. This, it could be argued, is the major advantage. Early Altman models were highly erratic three years before collapse and the availability of data in the final year may well mean that the collapse is visible before the accounts are published.

9 Wood and Piesse (1989) and other contemporary research

In a paper presented at the British Accounting Association conference in Brighton in September 1989, Wood and Piesse reported on their specific analysis of the UK automobile components industry. In this analysis, they identified 24 listed companies over the period 1974-86. During this time, four were acquired by predators, two had definitely failed, and one, Dunlop, went through a major reorganisation and was eventually taken over by BTR. The extent of the reorganisation was such that the company could be regarded as a failure. They tested the Altman, Taffler and Marais model and their findings were critical of the quality of

information efficiency available from Z-score analysis, since the accuracy claims are on an ex-post basis. In addition, when they compared the performance of individual ratios, there was little improvement.

Among the other more recent research in this area is work advocating Multidimensional Scaling and also logit analysis (Mar-Molinero and Ezzamel 1986). Logit analysis has the advantage of being statistically correct in contrast to many of the Z-score models, particularly those of Tamari and Edminster, where either/or variables are introduced. In the research the companies had to have been able to present financial data for at least 5 years, and be either in receivership or compulsory liquidation. Twenty-seven firms were identified as in this category, and 170 non-failed firms were compared with them. In selecting ratios, no underlying theory was developed, and the emphasis was upon ratios popular in the literature. (c/f Beaver 1966 and Robertson 1983) Despite the complexity of mathematics employed, the authors argue that the results can be readily and easily interpretated. In addition, they accept that there is no clear set of financial ratios that can be used as a representative data set for measuring the health of a firm but that there is some indication five years before the end, with marked deterioration in liquidity

and profitability in the final year.

Inevitably, this is not an exhaustive review. The authors detailed above have been selected for their potential contribution to the methodology of the research.

Other models have been developed, either because they are specific to an industry or geographical locality. For example, Mason and Harris (1979) have concentrated on the building and construction industry, while banks and financial services, have been the subjects of Meyer & Pifer (1970) and Copeland and Ingram (1983) and the commercial credit sector by Apilado (1974). From the geographic standpoint, van Fredericklust (1978) has developed a Dutch model, and a highly comprehensive study based upon legally required corporate returns, by Ooghe and Verbare study has led to the development of a a Belgian model.(1985)

<u>The Contribution of the Behavioural Aspect</u>

No review of the literature would be complete without some reference to the behavioural contribution. It has validity since, while most failure prediction models rely exclusively on financial data, the validity of non-financial data and behaviour cannot be discounted. Indeed, Lev (1974) in his evaluation of prediction techniques through ratio analysis calls for a more systematic comparison of the financial data with the

non-financial (p150).

The behavioural writers have therefore drawn attention to the qualitative and managerial aspects of corporate collapse. Formost in this field within the UK has been John Argenti (1977, 1983), who has argued that failure is a complex process which is unlikely to be modeled successfully by one equation such as a Z-score function. Rather, he believes that failure is something that takes many years to complete. As such, (and like Lau above) he identifies three distinct stages:-

i) There is something inherently wrong with the management especially in its response to change.

ii) They then make a major mistake.

iii) Finances start to deteriorate.

Clearly, Argenti is looking at a longer time cycle than perhaps the purely financial models would suggest. Indeed, it could be suggested, that (i) and (ii) above may occur fairly way back in a firm's history, and (iii) is the eventual result.

In the light of this, and after studying the aftermath of the Rolls-Royce collapse in 1971, Argenti has come up with an A-score based upon the premise that:-

- **Ratios even when combined can be misleading.**
- There will always be problems of different companies even in the same industry.
- There will be change within the mix of ratios.

In adopting this latter premise, Argenti has recognised the Tamari view, and is to some extent anticipating

Robertson and Lau. Equally, cognizance of the shortcomings of ratio combinations is acknowledging the perceived statistical shortcomings that have been the subject of the more quantitative approaches to the corporate failure problem.

Argenti's resultant list contains seven essential factors -

(i) "Top management" consisting of an autocratic or in the context of the USM, charismatic, combined chairman and chief executive surrounded by "yes" men. Non executive directors are passive, primarily interested in keeping their seats on the Board.

(ii) A lack of adequate accounting information, epitomised in a weak or even non-existent financial director, poor accounting systems, inadequate budgetary control, inadequate monitoring and control of cashflow and inadequate costing systems.

(iii) A lack of "depth of management". Instead of experienced operations managers, the team consists of "paper pushers" and men promoted beyond their level of competence.

(iv) The resistance to change and lack of the skills to adapt to change.

(v) Possible manipulation of the accounts:- window dressing, creative accounting, and an overall lack of consistency rather than blatant "fiddling."

(vi) A history of rapid, almost too rapid expansion.

This may be particularly important in considering the type of company that has come to the USM.

(vii) The economic cycle may have an effect. This may be relevant in considering companies growing and progressing through the 1980s. Certainly, out of sample studies, or repeating the exercise as Tamari did, goes some way to vindicating this viewpoint.

Perhaps in adopting this approach, Argenti, as per Robertson, is partially responding to the Lev appeal to identify determinants of failure and then develop a system of scoring. Inevitably, since qualitative characteristics are introduced, there will be a strong subjective element within the final score.

Nonetheless, Argenti has developed his A-score, the outline of which is summarised in Table 3.4. In essence, it awards points for managerial defects, managerial mistakes and symptoms. The total score is 100, with anything above an overall of 25 giving early warnings of danger. It will be seen from Table 3.4, that whatever misgivings Argenti may have about relying exclusively upon quantitative accounting data, his "score" really relies upon a straightforward use of univariate analysis of the accounts, a subjective interpretation of the accounting and managerial inadequacies already outlined, and the use of Altman's original Z-score albeit "adjusted" to suit a perception

Table 3.4 Computation of Argenti's "A-score"

Managerial defects	(pure)	19	
	(accountancy)	24	
(to pass, the sub-total had to be <10)		43	
Managerial mistakes		45	(pass <15)
Symptoms Bad Z-score		4	
"Creative accounting"		4	
Non-financial signs		3	
Terminal signs		1	
Total		100	

of UK conditions. At best, all that Argenti has achieved, is to suggest possible lines for investigation after discovering a poor Z-score. In that, he is crudely anticipating the approach adopted by the Bank of England with a fully quantitative model. Most analysts would follow such a methodology anyway and the efficacy of such an approach in the context of failure has been verified by Killough and Koh (1990).

Other behavioural symptoms identified in the literature are:-

Miller (1977) a Canadian who describes:-

(i) "Running Blind" - an impulsive, expansionist and ambitious power hoarding chief executive. (C/f Argenti)

(ii) "The Stagnant Bureaucracy" - the firm full of paper pushers dominated by an autocratic chief executive. This is similar to Argenti's resistance to change symptom.

(iii) "The Headless Firm" - A lack of definite leadership at the top with a consequent lack of Fayol's coordination. In the context of the USM, this could always arise from a succession crisis.

(iv) "Swimming Upstream" in the wake of past failures. This follows on from Argenti's concept of a major mistake, but compounding it, rather than trying to rectify it. A complete lack of overall strategic planning is also evident.

By contrast, another behavioralist, Homan (1984) identifies five major categories under which he groups a number of minor symptoms:-

(i)	Frivolous signs: (c/f Argenti)	Out of 16 e.g personalised number plates on the company Rolls, obsession with tax avoidance, no accountant on the board.
(ii)	Weakness in management	: (C/f both Miller and Argenti)
(iii)	Technical or commercial problems (Argenti)	: Volatile products, over dependence upon one particular market, poor pricing and costing systems. This could be an inherent problem with niche-market USM companies.
(iv)	Financing	: possible over-gearing, or high gearing in terms of norms for the sector, (Robertson) inadequate finance to expand, poor cashflow cashflow (Gentry et al) and deteriorating debt collection record. Adverse rates of debt finance are likely to be in this list also. (Watts and Zimmerman)
(v)	Faulty or "creative" accounting	: late accounts, changes in policy to remove consistency, inadequate or excessive information.

Three of the points highlighted above deserve comment in the context of companies on the USM. First, USM companies tend to be niche-market orientated. Thus, almost by definition, the companies are likely to be very dependent upon one or a very few particular specialist market(s). Secondly, USM companies are likely to have inherent financing problems. Many have come to the market specifically to gain long term finance and to reduce debt. Thirdly, late accounts are almost symptomatic of collapse in themselves and have been described as having a serious detrimental effect upon the credibility of the Z-score procedures.(Watts & Zimmerman)

More recently still,(1987) R S Norgard has identified 15 symptoms, which he has classified under two main headings.

Operational	Financial
Overtrading	Financial ratios
Margin erosion	Lack of cashflow forecasting
The "Big" Project	Lack of financial information
High gearing	"Creative Accounting"
Corporate inertia	
Changes to the business	
Problem borrowing	
Decline in service standards	

Undercapitalisation

Too much easy money

History of continuing losses

Some of the so-called "operational" symptoms could be considered under the financial category. Equally, some of the symptoms are unlikely to apply to USM companies.

Most of these qualitative approaches share a number of similarities. It is worth noting, however, that the Norgard approach is linked to a proprietary quantitative model known as FES which gives both a score and risk rating, a computer summary of key figures and ratios and facilitates manual credit assessment procedures. This has been developed into TIMES - (Total Integrated Management Evaluation System) by KMG Japan. Like Ooghe and Verbare's Belgian model referred to above,this has a certain amount of direct access into company information and can even get into day to day transactions, to give an almost continuous update.

Since this dissertation is concerned about success as well as failure, it is relevant to describe a qualitative success formula. The Peters and Waterman (1982) Success/Excellence model lists eight qualitative characteristics of success, some of which may be relevant to appraising successful performance.

(i) A bias for action and getting on with it.

(ii) Close to the customer - learning from the people they serve - unparalled quality service and reliability.

(iii) Autonomy and entrepreneurship - innovative

(iv) Productivity through people - good labour relations.

(v) Hands on value driven, top management close to the operations.

(vi) "Stick to the Knitting" - an aversion to conglomerates and concentrating on what the business does best. This is likely to be important to niche orientated USM companies.

(vii) Simple form, lean in staff organization. Very small corporate headquarters.

(viii) Simultaneous loose/tight properties. Such companies recognise that there is a case for both centralisation and decentralisation. There is decentralised operational autonomy, but highly centralised strategic philospohy.

This model was developed based on the research into 62 American companies over a wide range of industries and services. In that respect, it is similar to both the graduate population and the sample population of USM companies under consideration. There was quantitative financial growth included in this research over the period 1961-1980. The USM in its current format has only been in existence since 1981, however, the points raised may prove to be of relevence.

Concluding remarks

These come under three basic headings.

(i) Improved Models

From this survey of the literature, it is evident that a lot of research has been undertaken in order to

correct perceived shortcomings of the pioneering Z-score models. Attempts at improvement have focussed on models with apparently greater accuracy, and/or models that have greater statistical credibility. The results have been at best, indifferent. Models have become more expensive and the marginal increase in accuracy and reliability questionable. Indeed, the view of Killough, Koh and Tsui (1989) is salutory. They compared the discriminant analysis approach, with its recognised statistical shortcomings with the logit and probit based models and found that there was no consistent superiority in any of the methods over the others. Perhaps the pragmatic view of Marais and the Bank of England needs to be reiterated, that discriminant analysis provides a useful starting point for further examination and objective evidence of potential trouble ahead (Killough and Koh 1990).

(ii) Information Value

Schools of thought have criticised the information value of the models, especially since much of the research has been on an ex post basis. Other criticisms have stressed the over emphasis on the techniques without any thought to the need to develop an underlying theory. Little progress seems to have been made in this direction. A further viewpoint suggests that the high cost is not justified, since the results are little better than those achieved by single ratios.

(iii) The Behavioural Input

The input from the behaviouralists indicates that prediction of corporate performance, and of failure in particular may contain non-financial criteria. This responds to Lev's view and Argenti certainly makes a strong case for considering the wider implications of managerial decision making and skill, a view endorsed by Kharbanda and Stallworthy. In the context of USM companies, the behavioural view may give indicators of reasons for survival that are based on culture and tighter more responsive "top-down" control. However, such strengths, combined with a charismatic entrepreneurial flair may also contain inherent weaknesses, not least in problems of succession.

In developing future models, it may be that the approach adopted by Mar-Molinero and Ezzamel may hold the answer. A spectrum or map of characteristics, combining the indications of Z-scores and changes, managerial decisions and skill, and possibly even the changes in the economic climate. This latter point may vindicate the view that there is no universally applicable Z-score model, since different business sectors respond in different ways to economic changes.

CHAPTER 4 THE NATURE OF THE USM

Historical Background

The USM was established in 1980 to provide a formal market to meet the needs of less mature and smaller companies that would be unlikely or unable to apply for a full listing. At the same time, the requisite Stock Exchange regulatory control would be maintained under Rule 163. Rule 163 provided for occasional bargains matched by brokers. The USM was created to fit in between the official "main board" or fully listed companies and the Rule 163.

In considering the nature of companies entering the USM, the use of the term "less mature companies" in the Stock Exchange Green Book is important. It may help to develop a hypothesis about the inherent nature of companies still extant in the USM.

Historically, the concept of a "second tier" market is not new. It was first recognized as desirable in 1931 when the MacMillan Committee on Finance and Industry reported with a specific emphasis on the importance of small firms to the economy, and the need to provide such firms with access to adequate means of finance. The response to this was the establishment of the Industrial and Commercial Finance Corporation. Further investigations into the need of small firms to finance their growth have been the Radcliff Committee Report in

1959, the Bolton Committee Report in 1971 and the Wilson Committee report of 1979.

In the United States, the Small Business Administration was set up in 1953 to provide assistance to small firms. This assistance included the provision of long term loan finance. Later, in the wake of the Federal Reserve Report to Congress in 1958, Small Business Investment Corporations were set up to fill a perceived equity finance gap. The advantages of this, plus the establishment of an "over the counter" type market in the United States has enabled small companies to benefit from wider access to financial resources. (Davies and Pointon 1984)

As a result of this, in 1978, the Stock Exchange began publicising the availability of such arrangements to deal in unlisted securities under the thirty year old Rule 163. Many of these companies were from the Oil & Gas sector, who were anxious to raise funds for "fringe" oil and gas field exploration, without the complicated regulations of the American market, took advantage of Rule 163.

The creation of the USM in November 1980 was a response to both the perceived threat from the Over the Counter Market and the Wilson report of 1979. This report had highlighted the slump in stock market floatations

during the 1970 and the need for something to be done for small companies. It was perceived that many companies were not coming to the market because of the increased cost and formalities, plus the problem of size. The practical economic minimum size for a company to come for a full listing is about £5 million market value and a pre-tax profit of £0.5 million, figures which many USM companies satisfy with some considerable margin. The interesting aspect of this criterion is that it makes the typical USM company of similar size to Altman's companies, when considered in historical cost terms, although when measurements are made in constant price terms, they are normally smaller than Altman's original companies.

In the event, out of the 443 companies listed as having entered the market by 31.3.1986, some 144 had entered the market in the years to 1982. The need under the Stock Exchange regulations for a "track record" of three years indicates that these companies were trading and registered as "unlisted" prior to 1980. Of the 144, 76 were trading in 1980-81 and therefore were trading in 1978 when the Rule 163 facility was made more available. Expansion (Table 4.1) has been rapid as a result of publicity highlighted the demand from small companies and investors as well as creating the inevitable problem of investor protection.

Table 4.1 Number of Companies Admitted to the USM each year 1980-1989

Year	Number	
1980	23	
1981	60	
1982	63	
1983	85	
1984	98	
1985	96	
1986	91	
1987	72	Source: KPMG Peat Marwick
1988	87	McLintock USM Quarterly Report
1989	51*	December 1988

* Based on year to date figures, September 1989.

Although the pattern of entry is not important in the context of this study, the number of Rule 163 entries fell away sharply after 1981. In 1980, there were 10, and they were 43% of all the entries. In 1981, there were three, (5.2%) and in 1982 and 1984, one each. There have been no Rule 163 entries since 1984.

The Present Situation

The present situation is thus a three-tier system with a formal market outside the official listing. The USM occupies the second of these tiers:-

Tier 1 is the traditional full listing.

Tier 2 is the market for companies which wish to have their shares dealt in regularly. Such companies are

required to meet certain criteria on entry and be subjected to continuing regulation, but do not have to meet all the stringent entry requirements for a full official listing.

Tier 3 contains the traded "Over the Counter" stocks that may be only rarely traded, although with the creation of the "Third Market", some of these securities are now traded on a more regular basis. In 1990, in order to comply with E E C proposals for proposals for restructuring European capital markets, there are plans to merge most of the Third Market into the USM.

Chartered Accountants Robson Rhodes see the ideal candidate as having a trading profit of consistently above £100,000 per annum and a potential for long term growth. However, they do emphasise that the long term projections will be looked at thoroughly, since this is the key to success. It may be that this emphasis on potential rather than past performance explains why a number of USM companies show an indifferent Z-score before coming to the market, but the score improves substantially about entering the listings. (Cucksey and Medland 1984, Hutchison, Meric & Meric 1988)

Public relations literature about the USM emphasises:-

- young businesses that are growing quickly,
- dedicated and committed management that in most cases

have retained on average 70% of the equity after the float,

- joined the market within the last seven years, (This is inevitable since the market has only been in existence for rather less than 10 years.)
- growing companies, highly UK based.

(The USM Magazine Press Release post October 1987.)

Two points need to be added to the idealised profile above. First, the comment about retained equity may have some bearing on the continued existence of companies which ought to have failed. In fact, there are examples (such as Merrydown and Federated Housing) where the directors' and founders holdings have been reduced. The converse is also true, failures or likely failures where the holding remained high, (Bio-Isolates and Castle GB) and successes where the holding has remained high. Secondly, dedicated and committed management may equate with charismatic and entrepreneurial management which may be difficult to replace. The long term ability to survive the passing of the founder management and to accept an injection of new professional management may be critical to the eventual survival of USM companies.(C/f Argenti)

<u>The Debate about Advantages and Disadvantages of the USM</u>

Much of the publicity literature produced by the major accounting and advice firms anxious to gain valuable

business from successful USM introductions contains a list of advantages and disadvantages that can be derived from a USM listing. While much of this is irrelevant to the thrust of this thesis, a few points are relevant.

1 <u>In the area of advantages:-</u>

The advantage of access to additional funds reduces debt and is likely to have an advantageous effect on any score especially where there is emphasis on debt capital. In addition, since the lack of growth is seen as a characteristic of possible future failure, any means to stimulate growth such as the ability to make acquisitions by means of a share issue, can only be seen as advantageous. That the shares may come to the market at a premium will increase the reserves and possibly market value, both which could influence a subsequent score rating.

2 <u>In the area of disadvantages:-</u>

Inevitably, management becomes subject to constant scrutiny by the press and investors. Almost any event can become newsworthy, bad trading results, boardroom conflicts, even personal problems can influence the perception of the company, and possibly cause the shares to be depressed below the net asset value, which can in turn reduce the company's ability to operate and increase its vulnerability to a predator. This has two identifiable consequences. Firstly and almost inevitably, a volatile element is brought into the share price which

could effect the Altman score, while secondly, it may have an exacerbating effect from the standpoint of Argenti's A score.

This may be an inherent problem. The very nature of a significant proportion of the companies that have come to the market renders them prone to enjoy the publicity element but very vulnerable to the impact of adverse publicity. Two of the more spectacular examples of this unfortunate aspect of corporate life in the USM have been Pineapple, an early entrant which has had to undergo a major but ultimately unsuccessful reorganisation to survive and Sock Shop (dealings suspended with £16 million debts February 1990).

Profile of the Typical USM Company

Typically, the USM candidate has initially achieved the status of a public limited company having passed the resolution under $43 of the Companies Act 1985. From a financial standpoint, the £500,000 minimum market value will have also been satisfied. However, there has been wide fluctuations in size, from Midsummer Inns with a mere £551,000 to Acorn with £13.7 million. Ironically, the latter has been one of the USM's less than happy histories. Up to 1985, Chartered Accountants and USM specialists KPMG Peat Marwick McLintock reported 20 were capitalised over £12 million, with a median range of £3-4 million.

Financial advisors Hoare Govett perceived such companies as being dynamic, cash hungry, young but not infants, and as such are unlikely to be vulnerable to the mortality rating inherent with infant companies. Commercially, the emphasis on the high technology manufacturing sector and emerging specialist services. Many of the early candidates were identified as coming from management buy-outs, old firms starting with a new lease of life, rather than completely greenfield start ups. Indeed, Rawsley (1984) argues that such companies performed indifferently in the early years of the USM's development. The predominance of older firms in the early years was shown in 1984, in that while 22% of the USM companies were younger than 5 years, 37% were over 15 years old. (Bannock and Doran 1985)

From a qualitative standpoint, would-be investors were perceived to be concerned about:-

- managerial ability and the impact of reorganisation
- range and depth of managerial skills and continuity
- managerial succession and service contracts
- impact of the burden of the new reporting demands

In addition, the trading risks that the company would be likely to face were considered important. Under this heading were dominant contracts, customer base, supplier base, product range, exposure to innovation and technical change, competitors and ease of market access, workforce

and labour relations, management organisation and asset replacement. It is worth noting that the lack of many of the above criteria make up Agrenti's "A" score (1976,1977).

Type of Company Entering the USM

The guiding philosophy of the USM is to provide finance for small but growing companies who might never otherwise reach the situation where they readily qualify for, or justify, a full listing. In the light of the comments made by Hoare Govett it is not surprising to find 41% of the companies entering the market come from only four clearly specified industrial sectors. (Table 4.2)

Table 4.2 Analysis of Type of Company Coming to the USM

Industrial Sector	Number	
Hire Purchase etc	3	
Beers, wines etc	8	
Building etc	14	
Chemicals	7	
Drapery & Stores	29	(6.5% of total)
Electricals	91	(20.5% of total)
Engineering etc	4	
Food & Groceries	21	
Hotels & Caterers	11	
Industrials (Misc)	87	(19.6% of total)
Insurances	5	
Leisure	30	(6.8% of total)
Motors & Aircraft	7	
Paper & Printing	36	(8.1% of total)
Property	26	
Textiles	1	
Investments etc	16	
Oil & Gas	31	(7% of total)
Plantations	2	¦Source: KPMG Peat
Miscellaneous	14	¦Marwick McLintock
Total	443	¦USM Quarterly Survey
		¦April 1986

The table above shows a domination of only four sectors,

electricals, (the largest single sector) drapery & stores, leisure and publishing. Very few come from what might be regarded as traditional capital goods manufacturing sectors. This would make the typical USM company somewhat different from the type of company analysed by Altman and indeed to a lesser extent, by Taffler also.

Just as the emphasis on electricals confirms Hoare Govett's description of emphasis upon the high technology manufacturing sector, "Miscellaneous" embraces a wide variety of esoteric specialist services. Under that heading would come specialist design houses - Blanchards, Bluebird Toys, and John Michael Design, (now the JMD Group), thoroughbred horses [British Bloodstock] private professional education [Chart Tutors - (taken over 1986) private health care (Swindon Private Hospital and West Yorkshire Independent Hospital). This in itself eloquently demonstrates the change in UK commercial life, where against a background of entrepreneurial inventiveness and opportunism, there has been considerable expansion in electronics, a rising use of sub-contract specialists, a growing demand for services, due to greater leisure and spending power in terms of disposable income for eating out and keeping healthy. Additionally, the areas where market entry requires a low level of initial investment have been focussed upon. This

creates a pattern that contrasts markedly with the kind of commercial profile that attracted Altman in his initial surveys.

Comparison of USM Companies with Altman's Original Research

Altman's initial 66 companies were traditional manufacturing based corporations. Indeed, his original model, when transferred to capital intensive service industries i.e. railroads, was less successful and other ratios were found to be needed. (Altman 1973) By contrast, the USM is poorly represented in what might be described as the traditional manufacturing areas. As Table 4.2 illustrates, there are only seven in the chemical sector, fourteen in building and construction, and only four in engineering, although the latter sector has increased substantially since 1986. Additionally, while there is a dominance in electrical/electronic, "industrials" and paper and printing, these sectors contain a wide variety of related activities, primarily distribution and support services rather than mainstream manufacturing or assembly. As a result any investment is likely to be lower than in the traditional Altman company and there may be an inherent bias within the USM for low initial investment easy entry type companies. A further aspect that needs to be considered is the relative size of USM companies. Altman looked at $25 million asset value in the mid 1950s. To appreciate the size

difference, Table 4.3 lists some USM companies as at 1985, and scales down the data to 1955 values. The calculations are based upon OECD/UNO deflator price gross national product indices.

Table 4.3 Comparison of Size between USM companies and Altman's typical company

Company	Turnover			Gross Asset Value			Total Debt		
	£	$	$	£	$	$	£	$	$
		1985	1955		1985	1955		1985	1955
Merrydown	8.8	11.5	3.2	4.0	5.2	1.4	2.1	2.8	0.8
Oceonics	70.4	91.5	25.3	50.5	65.7	18.1	34.8	45.2	12.5
Castle GB	15.7	20.4	5.6	9.9	12.9	3.6	8.0	10.4	2.9
Fed House	27.9	36.3	10.0	7.5	9.8	2.7	11.6	15.1	4.2
McCarthyS	37.9	49.3	13.6	77.6	101.	27.7	41.4	53.8	14.9
Body Shop	9.4	12.2	3.4	4.8	6.3	1.7	3.2	4.1	1.2
Robt Horn	123.	160.	44.2	52.7	68.5	18.9	34.0	44.2	12.2
Carlton C	38.1	49.5	13.7	42.6	55.4	15.3	19.2	24.9	6.9
Microgen	23.1	30.0	8.3	11.1	14.5	4.0	8.0	10.4	2.9

£1(1985) = $1.30 Source: Hambro Company Guide

It will thus be apparent that most USM listed companies are smaller than the companies originally analysed by Altman, but not dramatically so. Those that are closest in likeness to the original profile, such as Builders and manufacturers of Paper and Paper Products are in fact similar in size.

Profile of Typical USM Companies

In order to obtain an appreciation of the nature of a typical USM company, general profiles of the four types

of company discussed in this dissertation are now presented.

Profile of the Graduate

From analysis of data in the Hambro Company Guide, it will be observed that at the end of 1987, a typical USM graduate company is likely to have:-

- a turnover of between £25 and £100 million
- a gross asset value of between £10 and £25 million
- a profit before tax:turnover ratio of greater than 10%
- a total debt below £25 million if not below £10 million,
- a negative no credit interval, and
- an acid test ratio of <1:1

In addition, the Hutchinson, Meric, Meric (1988) study finds that USM companies have experienced an acceleration in turnover growth rates, might use more debt finance and have less investment in current assets.

It is likely that USM companies graduating to the main list on the Stock Exchange will come from one of the five major sectors identified in Table 4.2 with graduation taking place between 2½ and 3 years after first entering the listings. It is worth adding that some of the graduate companies have achieved ranking among the very best of UK companies. Graduate USM companies that have achieved this status from among the traditional sectors are Bespak, McCarthy & Stone, and the Robert Horne Group,

(taken over by Buhrmann Tetterode NV Summer 1990) while Carlton Communications and Microgen Holdings are graduates which are much more typical of the type of coming to the USM.

In addition, it is possible to guage the perception of the standings of such companies from the Hambro Performance Rankings Guide. This shows how companies compare within both their sector and the market in terms of performance percentile rankings (with 1% implying at the top, and 100% near the bottom) based on performance measured in terms of inter alia turnover, pre-tax profit, growth and liquidity. From the 1988 edition, it is evident that during 1986-1987, a typical USM graduate company is likely to be ranked as shown in Table 4.4.

Table 4.4 Performance Ranking of a Typical USM Graduate 1986-87

Measure	Position	
Turnover	Second quartile	
Profit	Second quartile	Source: Hambro Performance Rankings Guide 1988
Growth	Top quartile	

Thus, in terms of the criteria tabulated above, a USM graduate company will rank within its industrial sector and the total market between 26-50% in terms of turnover and profit, and between 1-25% in terms of growth. That such companies should be among the top for growth vindicates both the Robson Rhodes and Hoare Govett perception of potentially successful USM companies.

Conversely, it should be noted that a USM Graduate is very unlikely to be ranked below 75%.

Profile of the Non-graduate USM Company

This describes a USM company which, while not a graduate, is still successful and has a history of profitability. Typically, from data in the Hambro Guide, such a company can be identified as being characterised by having:-

- a turnover of between £10 and £25 million, somewhat smaller than the graduate USM company,
- a gross asset value and total debt of less than £10 million each,
- likely to have a negative No-credit Interval,
- an Acid Test Ratio of <1:1,
- a net profit before tax:turnover ratio >10%.

Since such a company is smaller than the graduate, it will be substantially smaller than the classic Altman company. When compared with a graduate, it is likely to be less spectacular in its performance rankings. Indeed, there are no clear cut groupings of non-graduate companies as there are with the graduates. The only ranking that comes anywhere near is capital employed in that USM graduates are ranked in terms of capital employed between 26-75% while non-graduates are typically ranked between 51-100%.

Non-graduation should not be perceived as a short coming or even a failure. Two surveys conducted in 1983 and 1985

by Chartered Accountants Spicer and Pegler revealed that while such companies may have a full listing as a future long term objective, there were good reasons for remaining in the USM, namely cost of a full listing, investors perceptions that they are too new and anxiety about the 25% holding, for remaining in the USM. These reasons are summarised in Table 4.5.

Table 4.5 Reasons for Successful USM Companies not seeking a Full Listing

Reason	Very significant %		Reasonably signifianct %		Not significant %	
	1985	1983	1985	1983	1985	1983
Expensive	35	42	29	30	36	28
Too new	22	17	25	15	53	68
25% public holding	20	7	12	8	68	85

Source: Going Public The USM and OTC Experience Spicer and Pegler 1985

Profile of an "At Risk" Company

As part of the analysis and the review of methodology, a number of companies deemed to be "at risk" have been identifed. Such companies have not necessarily failed, but have turned in low Z-scores, had persistently poor profit and liquidity records, needed possible reorganisations and even changed quite considerably. In some cases, their very survival would seem to vindicate the qualitative view advocated by Argenti, that survival may be the result of good management making the right

decisions at the right time. Where the company benefited from the drastic managerial action, it was subsequently excluded from the analysis. Such "at risk" companies can come from both the graduate and non-graduate groupings. graduate groupings. Table 4.6 summaries these companies.

Table 4.6 "At Risk" Companies

Name	Group	Event/Characteristics
Bio-Isolates	Non-grad	Persistent bad Z-scores
Entertainment P S	Non-grad	Reorganised 1988
Greenwich Comm	Non-grad	Indifferent performer Reorganised
Pineapple/Prospect	Non-grad	Reorganised 1989
Paul Michael	Non-grad	Reorganised 1987
Britannia Security	Graduate	Indifferent performer
Mellerware	Graduate	Needed to reorganise 1987
Microfocus	Graduate	Indifferent performer
Oceonics	Graduate	Indifferent performer
Anglo-Nordic	Graduate	$425 merger 1987.
Air Call		Acquired 1986
Humberside	Chapter 7	Reorganised 1988.
Wm Morris	Chapter 7	Reorganised 1988.
Crown		Reorganised 1988
Healthcare		Successfully reorganised 1983-4
John Michael		Reorganised 1988
Thorpac		Reorganised 1988

Note: The references to Graduate, Non-graduate and Chapter 7 in the Table 4.6 above indicate that the

company has been analysed under one of those headings. The five not allocated to one of these groups were added because of later events.

Profile of a Failure

Table 4.7 profiles the pattern of failures, defined by KPMG Peat Marwick McLintock as those companies which have been suspended or had their quotation cancelled.

Table 4.7 Pattern of Suspensions/Cancellations

Year	Entries		Suspended/Cancelled		Cumulative
	Year	Cumulative	Year	Cumulative	%
1980	23	23	3	3	13.0
1981	60	83	4	7	8.4
1982	63	146	4	11	7.5
1983	85	231	8	19	8.2
1984	98	329	3	22	6.7
1985	98	427	2	24	5.6
1986	90	517	2	26	5.0
1987	72	589	1	27	4.6
1988	87	676	2	29	4.2
1989*	51	727	2	31	4.3

* Cumulative to September 1989
Source KPMG Peat Marwick McLintock USM Survey

As at the end of September 1989, 31 USM companies had failed as defined above. The percentage shows the cumulative pattern of failures, as a proportion of companies coming to the USM. Inevitably, as the market has progressed, the failure percentage has declined. A cumulative percentage failure of 4.6% at the end of 1987

and 4.3% by September 1989, compares well with the generalised failure expectation of Taffler (1982) of 10% but does not appear to correspond with the Altman et al (1977) 1% annual rate. In the bullish economic conditions, with perceived potentially successful companies, that the percentage is small and better than expectations is not perhaps surprising. As to characteristics, it is likely that the symptoms suggested by Robertson (1983, 1984) may be a dominant feature of the typical failure, and this is discussed in Chapter 7.

Concluding remarks

The outline profiles provide a good indication of the type of company under examination. The companies are typically small indeed much smaller that those tested in Altman's initial research, but nonetheless well established. All have youth, so the comment that failed companies tend to be younger than non-failures (Lev 1974) does not apply. Being well established removes any possibility of failure arising from Argenti's "infant mortality". There is no obvious pattern of size, or even industrial sector as Table 4.8 shows. Equally, with only 31 failures out of 727 entrants and 458 still extant within the market, is suggestive of an ability to survive that may be better than average for listed companies. Indeed, when Table 4.8 is compared with Table 4.2 above, it is inevitable that the pattern of suspensions and

cancellations reflects the sectors where the USM companies are prevalant, i.e Leisure, Other Industrials and Electricals/Electronics. However, at present, no sector appears disproportionally represented among the

Table 4.8 Suspensions/Cancellations
Industrial Grouping

Grouping	Number
Contracting	2
Electronics	4
Motors	2
Other Industrial	4
Food (Manufact)	1
Food (Retail)	1
Health	1
Leisure	4
Stores	3
Agencies	2
Conglomerates	2
Miscellaneous	2
Oil & Gas	1
Property	2
Other Finance	1
Total	31

Source KPMG Peat Marwick McLintock USM Survey September 1989

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casualties. What may ultimately prove interesting as the economic climate changes, will be to see how extant USM companies and the Graduates perform within the sectors most at risk, such as Drapery & Stores and Leisure.

CHAPTER 5 TESTING THE ALTMAN AND TAFFLER MODELS ON THE GRADUATE COMPANIES

For this chapter and the two that follow, the Altman and Taffler models are tested to see how well they classify companies in line with an expected hypothesis.

Within the overall population of USM entrants, three groups of companies have been identified:-

1 The Graduates - companies that have transferred to a full listing.

2 A sample of USM companies who have not made the transfer. (These are discussed in Chapter 6.)

3 The "failures" which are discussed in chapter 7.

This chapter will deal exclusively with the Graduates.

The Graduates - Definition and Characteristics

The Graduates are the 108 USM companies [as at 31.12.1987] that have transferred from the USM to the Full Listing and therefore have satisfied the requirments laid down by the Stock Exchange for a full listing. It should be noted from chapter 4 that "Graduation" in itself is not a single feature of success. Rather, to have graduated to a full listing, such companies will have had to have satisfied the rules laid down by the Council for the Stock Exchange; - the "Yellow Book". The book gives little guidance as to the performance criteria that need or perhaps ought to be satisfied. However, some quantitiative criteria

are quoted.

As an indication of size, (and an implied success arising from the proportion of share premium and hence goodwill), the "Yellow Book" expected market value of the securities for which listing is sought must be at least £700,000 in the case of shares. A lower figure will, however, be accepted if there is an adequate market for the securities.

In addition to the £700,000 requirement, there is a similar requirement for information with respect to the profits and losses, assets and liabilities, financial record and position in the form of an audited accountants' report. The most significant aspect of this prerequisite is that it is for the 5 years preceding the application for the listing, and the earnings per share details for the three years preceding the application for listing.

Thus, while it is no indicator of inherent success within itself, "graduation" does indicate a reasonable period of longevity, satisfying the criterion outlined in "In Search Of Excellence" (1982) and the requirement for retained profit in the Altman Z score.

Inevitably, not all the graduates have been listed on the USM for the full duration of the five year period

under review. However, the 32 that have, exhibit an average growth in turnover during the period of 5.8 fold, indicating an average annual growth of around 16%. However, it is evident from the Hutchison, Meric, and Meric (1988) study that the likely pattern is to show acceleration in growth after coming to the USM, with some further acceleration after graduation to the full listing. In addition to growth in turnover, a similar pattern for asset value can also be identified. Here the average for the five year period is 7.5 fold, indicating an average annual growth in assets of 50%.

However, when the scores for the graduates are analysed, this pattern of growth and progress is not so patently evident. Part of the reason for this is that a substantial proportion of the graduates had come to the before the period of the study i.e. pre-1983 and therefore few pre-issue scores were available. As such, only 14 were identified as fitting the criterion of having scores which showed improvement after coming to the market, while post graduation produced a slightly larger group of 21. However, there was evidence that if the Altman score was taken in isolation, a larger group was identified, suggesting that the Altman score was more sensitive to the changes. This may be due to

the fact that the Altman score includes growth measures such as asset value and sales turnover, the latter being a numerator. Finally, it should also be noted that the Altman score contains a market price element, which would be boosted by a successful issue and graduation. However, in a number of cases, the reverse happened. Either there was no obvious improvement in

Table 5.1 Analysis of the Industrial Categories of the USM Graduates (31.12.87)

Industrial Sector	Number	%
Hire purchase	2	1.8
Building	2	1.8
Drapery & Stores	2	1.8
Chemicals & Plastics	2	1.8
Electricals	21	19.5
Engineering	1	0.9
Hotels & Caterers	4	3.6
Industrials	18	16.7
Food & Groceries	2	1.8
Leisure	7	6.6
Paper/print/ publish	18	16.7
Motors & aircraft	1	0.9
Property	13	12.1
Financial services	9	8.4
Oil and gas	6	5.6
	108	100.0

Source: KPMG Peat Marwicks USM Market Surveys April/May 1986 & December 1988.

the score, or the score actually declined.

Approach to the Analysis

The total number of companies selected covers most of the industrial sectors wherein USM companies might be found. The analysis by industrial category is to be found in Table 5.1 above.

Methodology

The companies were analysed using Altman 1968 and Taffler Z-scores for the five year period from 1983 to 1987 using the published data from the Hambro Company Guide. Non-availability of data for 31 companies, plus the exclusion of oil and gas, insurance, property and investment companies reduced this figure down to around 68 companies. The exclusion of such companies was because it was felt that since they derive their profits and turnover from capital growth rather than conventional trading, they would not be typical. Indeed, insurance companies frequently do not have a turnover in the accepted sense.

The slight variation in the number of companies from year to year was due to some companies not coming to the USM until after 1983 and hence no data being available, while others had been acquired and hence deleted from the listings before the end of 1987. The mean and standard deviation figures are summarised in Table 5.2.

Analysis of the Results

To begin to test the initial hypothesis, Table 5.2 gives a summary of the mean Z-scores under review. It is apparent, as might be expected, that the Taffler score consistently averages >0.0 and indeed >0.3, while the Altman mean is consistently >2.9. Since Taffler's successful companies have to exhibit positive Z-scores, it was inevitable that all the scores should be

Table 5.2 Summary of Taffler and Altman Results.

	Taffler					Altman				
Year	1983	1984	1985	1986	1987	1983	1984	1985	1986	1987
n	61	66	68	65	63	61	66	68	65	63
μ	.352	.384	.397	.405	.409	4.41	4.63	4.68	4.69	4.70
σ	.169	.169	.170	.190	.245	1.91	1.78	1.77	2.10	2.12
μ-2σ	.014	.046	.057	.025	-.08	0.59	1.07	1.14	0.49	0.46
t	16.2	18.5	19.3	17.2	13.3	5.99	7.89	8.26	6.86	6.72
t	2.4	4.1	4.7	3.5	6.0*					

* Based on the hypothesis of an 0.3 cut-off.

positive. Indeed, from Table 5.2 above, in all years except 1987, the value of (μ - 2σ) was >0.0. This was to be expected, since by the very nature of the position as graduates, such companies would be perceived successful, and as such have a positive Z-score. The hypothesis that these companies exhibited Z-scores greater than zero was formally examined via Student's t-test. In all instances, highly significant

test statistics were obtained, confirming our expectations.

The Taffler score was also tested to see if the graduates exhibited a consistent pattern above >0.3. While this is above Taffler's 1982 suggestion of 0.2 as a cut off for exhibiting the characteristics of collapse, the results nonetheless revealed that the graduates were largely successful, unlikely-to-fail companies, exhibiting Z-score means in excess of 0.3. Student's t-test was applied to both sets of data to confirm that the results were statistically significant. Even so, whatever the cut-off point, be it 0.0 as in the 1987 Taffler paper, 0.2 or 0.3, it may be possible to imply that there is a grey area for the Taffler score between 0.0 and around 0.3.

For Altman, graduate companies would expect to be scoring >2.9, since they could be presumed as unlikely to collapse. Again, the t-test was employed to test this contention and expectations were confirmed. However, closer examination of the raw data showed that although the overall means were greater than 2.9, there were still companies in each year with scores below even 1.8.

The pattern of the results in Table 5.2 is to be

expected. Overall, the means are characteristic of successful, growing companies. However, it should be noticed that while the means tend to increase, so are the standard deviations and this is affecting the lower limit of $(\mu - 2\sigma)$. Both scores indicate a wide spread in the first year, 1983, caused by some pre-USM entry figures being included in the analysis, with 1984-1985 being the best. 1986-87 show evidence of an increase in the spread again, possibly due to the early signs of economic slow-down in the UK economy. This impact of this apparant general trend is discussed later in the present chapter.

Since both the Altman and Taffler Z-score models purport to show the same thing, i.e. a pointer towards future continuing survival or collapse, it is logical to examine the correlation between the two sets of results. The results of the Pearson's correlation coefficients between each year are listed in Table 5.3.

Table 5.3 Correlation values Taffler/Altman

Year	1983	1984	1985	1986	1987
R	.6127	.6487	.6140	.6526	.6942

These coefficients are all significantly different from zero. Hence, there is a suggestion that the two sets of scores are linearly related in a positive sense year by year. The strength of this association generally

increases from 1983 to 1987 with the highest figures in 1986 and 1987. This may be due to a greater inherent stability as the companies progress away from first entering the listings and move through graduation.

In addition to the correlation exercise, the SPSS package was used to perform factor analyses on the data. The essence of this technique is to replace the original variables, in this case the Taffler and Altman scores by a small number of "underlying" variables. Broadly speaking, the object is to reduce the complexity or dimensionality of the data. The use of factor or cluster analysis is not new to the analysis of financial data. Watts and Zimmerman (1986) cite research undertaken by Kaplan and Roll (1972) that identified associations in investment tax credit changes in one particular year, while changes in depreciation were found in three years. Other studies have been undertaken by Gupta and Huefler (1972) who investigated growth in turnover ratios, and Gombola and Ketz (1983) who researched financial ratios and corporate liquidity.

The results in Table 5.4 show that both Taffler 83-85 and Altman 83-85 possess a high common features reflected in factor scores. This is identified mathematically as "Factor 1". These six variables have

thus formed a cluster correlating highly with each other, yet remaining distinct from the remaining variables. "Factor 2" produces a second cluster involving Taffler 86-87 and Altman 86-87. Consequently, without a significant loss of information, our data may be reduced to two sets; [i] the years 83-85 and [ii] the years 86-87. These two sets of data are similar amongst themselves, but dissimilar between the two sets. It maybe significant that the higher degree of linear correlation in Table 5.3 is emphasised in the clustering in Table 5.4. A contributing factor to the 1983-85 cluster pattern may be the impact of newer,

Table 5.4 Results of Cluster Analysis

		Factor 1	Factor 2
Eigenvalue		4.92	2.37
Cumulative % of variance		49.2	72.4
	Year		
Taffler	83	**.78553**	.07601
	84	**.85093**	.32308
	85	**.67475**	.55576
	86	.22801	**.81971**
	87	.01400	**.85470**
Altman	83	**.83097**	-.17185
	84	**.82957**	.13358
	85	**.71221**	.26278
	86	.18126	**.85195**
	87	.08018	**.89392**

more euphoric companies entering the listings in a bullish economic environment. Clearly, 1984-85 were the years when the most entrances were made, and 1983-84 when the largest proportion "graduated." Conversely, the 1986-87 cluster may also reflect that conditions for USM Graduate companies were beginning to show changes which impinged upon their performance, and it was these changes that were beginning to emerge in 1986-87.

Assessment of the Reliability of the Models

To test the efficacy of the hypothesis and hence the models still further, the classification of the companies by the models needs to be analysed. Table 5.5 summarises the initial results. Correct classification implies that as Graduate USM companies they should be successful and as such, have scores that reflect success. In addition, however, it should be expected that there may be companies that are at risk, i.e. in a grey area, and any potential failures recognised. Thus the table below identifies the proportion of the annual population correctly classified as being unlikely to fail, "at risk" or a potential failure.

From Table 5.5 the initial results reveal that Taffler's model correctly classifies USM graduates as successful companies on average just over 80% of the time. There is a trend for the results to improve from

Table 5.5 Summary of Initial Classifications

Taffler | Year	1983	1984	1985	1986	1987	
n =	61	66	68	65	63	
Unlikely >0.3	46	51	57	54	54	
"At risk" >0 - 0.3	14	14	11	10	8	
Possible failures	1	1	-	1	1	
Total %	75	77	84	83	86	μ = 81.0%
Altman						
Unlikely >2.9	50	56	63	65	63	
"At risk" >1.8 - 2.9	9	9	4	12	7	
Potential failures	2	1	1		2	
Total %	82	85	93	82	86	μ = 85.6%

below 80% in 1983-84 to almost 90% in 1987. Altman has a similar level of performance, but although the overall average percentage of expected correct classifications is 86% the pattern of the results is more erratic.

However, the reliability of the models to classify companies *per se* is an essential part of this analysis. This means that the classification should be able to identify the successes and any misclassifications must be explained. This means the scores must classify any failures or potential failures that may be among the graduate population. To do this, first, we can adjust

for any companies that fall into the Hutchinson Meric Meric analysis, i.e. show low scores either before coming to the USM and/or before graduation, on the basis of their hypothesis that entry to the markets stimulates growth which will be reflected in an improved Z-score. As explained in chapter 4, market analysts and promoters look for long term potential rather than just the historic performance when assessing candidacy for the listings. Thus a probable entrant could exhibit a Z-score that is lower than the cut offs, but not indicative of failure. Since failure could only by judged objectively by using the revised Altman model for private companies described in Kharbanda and Stallworthy (1985), it becomes pertinent to add back the companies whose low score could be construed as relating to pre-USM entry. Inevitably, such an adjustment will have considerable impact on the Table 5.5 results in the earlier years, notably 1983 and 1984. In addition, any failure classifications can be identified. Table 5.6 shows the results of this adjustment, there being no warnings of collapse indicated by the parameters.

The second adjustment that can be made reflects the possibility that the fixing the Taffler cut off at 0.3 may be too high. Since Taffler 1982 advocates a 0.2 cut off, it is reasonable to consider that accuracy of

classification can be improved by adopting that cut-off level. Table 5.6 shows the classification results after allowing for any apparant misclassifications that can

Table 5.6 First Revised Taffler Assessment

Year	1983	1984	1985	1986	1987
n =	61	66	68	65	63
Per Tab 5.5	46	51	57	54	54
Adjust for non entrants	10	4	1		
Revised total	56	55	57	54	54
Revised %	92	83	85	83	83 μ = 85.2%

be explained by Hutchinson Meric Meric, while Table 5.7 shows a revised Taffler Assessment, introducing the impact of adopting an 0.2 cut-off point.

Table 5.7 Second Revised Taffler Assessment (based upon Taffler 1982 cut-offs)

Year	1983	1984	1985	1986	1987
n =	61	66	68	65	63
Z = >0.2*	54	61	62	61	60
Pre-USM	4	1			
Potential failures	1	2	3	2	1
Revised total	59	64	65	63	61
Revised %	98	97	96	97	98 μ = 97.3%

*Note: Some of the new entrants had scores between 0.2 and 0.3. Since these companies have been successful since, they have been incorporated into the non-failed group.

This clearly improves the Taffler classification rate substantially. However, such a cut off is insensitive to the one major collapse among the graduates during the 1983-87 period, that of Anglo-Nordic, and the warning scores (i.e. <0.2) are equivocal, merely suggesting the possibility of collapse to a small group of companies, none of whom have actually collapsed yet. This is in keeping with the basic Taffler conclusion, that companies are displaying characteristics in keeping with companies that, in the past, have ultimately failed.

Turning now to Altman, the same exercise can be performed, firstly to allow for any adjustments for the Hutchinson Meric Meric analysis, and secondly for any identifiable adjustments for misclassifications. Table 5.8 summarises the results of this exercise. Ostensibly, as with Taffler, there is an apparent improvement and when compared with Taffler, a slight edge still remains. However, the improvement is not as marked as in Table 5.7, when the Taffler 1982 cut-off is employed. What is more significant is that the model has, unlike Taffler, indicated the ultimate demise of Anglo-Nordic, given an early warning about Leisure Investments, and the need of Mellerware/Beacon to

Table 5.8 First Revised Altman Assessment

Year	1983	1984	1985	1986	1987	
n =	61	66	68	65	63	
Unlikely	50	56	63	53	54	
HMM	5	2				
"At risk"				1	1	
Failed				1	1	
Re-organised				1	1	
Revised total	55	58	63	56	57	
Revised %	90	88	93	86	90	μ = 89.5%

undertake an urgent re-organisation.

Two other possible modifications can be considered. Altman revised the top cut-off point down to 2.7 and it is this cut off point that Wood and Peisse (1989) use in their appraisal. Equally, Argenti, (1983) in his interpretation of Altman, altered both cut offs, producing an upper limit of 2.0, and a lower limit of 1.5. Tables 5.9 and 5.10 summarise the results of this analysis.

Again there is an apparent improvement, the correct classification percentage increasing to 91.2%. The only failure is identified and a warning given to a company that eventually failed sometime after the period under review. The only real impact that adopting the 2.7 cut-off has is to take out the top of the "at risk" grouping (i.e. 2.7 - 2.9) companies which may have a

Table 5.9 Second Revised Altman Assessment
(Based upon Success >2.7)

Year	1983	1984	1985	1986	1987	
n =	61	66	68	65	63	
Unlikely (Tab 5.5 above)	50	56	63	53	54	
Impact of Revision	1	5		1	1	
HMM	5	2				
"At risk"				2	1	
Failure					1	
Revised Total	56	63	63	56	57	
Revised %	92	95	93	86	90	μ = 91.2%

better long term future. Argenti's interpretation of Altman removes much of the need to adjust the results for the impact of the Hutchinson, Meric, Meric findings since the failure and success cut-offs are so low.

Table 5.10 The Impact of the Argenti Interpretation

Year	1983	1984	1985	1986	1987	
n =	61	66	68	65	63	
Unlikely (Table 5.5)	50	56	63	53	54	
Impact of Revision	8	9	4	8	5	
HMM	2	1				
Revised Total	60	66	67	61	59	
Revised %	98	100	98	94	94	μ = 96.7%

However, the few remaining misclassifications are, in fact all incorrect. Potential failures that have yet to

fail are identified, while the two ultimate failures among this population of graduates are not identifed.

Preliminary Conclusions

Taking an overall view of the results, there is no apparent evidence of any sector being dominated by, or even having an excessive number of apparent mis-classifications. There is a 23% apparant mis-classification of electrical companies by the original Altman, but much of this is due to five companies having persisently low scores. This may vindicate an opinion that the cut-offs for the electrical sector may need adjusting. The other sector where there is a a possible high proportion of mis-classifications is Leisure, where both models show a group of companies that have persistent bad scores. There is no apparent trends among these sectors or any others to warrant detailed analysis at this stage.

The apparant "falling back" of the performance of both Z-score models may be a reflection of the change in the economic climate. 1983 and 1984 were still early days for both the market and many of the companies. Even so, the models perform adequately when allowance is made for the Hutchinson Meric Meric pre-entry factor. 1985 was the year when there were the most entrants. Since then there has been a general slowing down, and the USM

itself is less active. Slightly fewer companies have come to the market, and acquisitions and graduations have fallen away almost to a trickle, with none at all in the 21 months after December 1987. At the same time, a more steady trend of failures is beginning to emerge.

It can be concluded that the models appear to correctly classify companies with a high degree of success. However, the success rate is based upon successful companies rather than failures, appearing to vindicate the criticisms levelled at Z-score methodology. Such a view would certainly find support among the memebers of the "paired sample school" of methodology. That the the misclassifications do appear to occur in certain specific sectors may confirm the critical view that either Z-scores do not have universal application, or, as the score patterns in certain sectors might suggest, there may be inherent behavioural or cultural factors that keeps a company, and a USM company especially, ostensibly viable in complete contradiction to the financial figures when these are taken in isolation. This would vindicate Lev's view, that must go beyond the pure financial data. What may also be true is that the misclassifications are too small in number, and the populations too small for any significance to be concluded. This may confirm the

Watts and Zimmerman viewpoint.

Further overall concluding remarks are at the end of Chapter 7.

CHAPTER 6 TESTING THE ALTMAN AND TAFFLER MODELS ON THE NON-GRADUATES

This chapter analyses a random sample of approximately 60 out of the 324 (i.e approximately 20%) USM companies that were on-going as at the August 1988 Quarter issue of the Hambro Company Guide. The method of selection was to take the published list, number the companies and select using random number tables. The four industrial sectors excluded from the earlier graduate analysis (Chapter 5 above) were also excluded from this analysis. A summary of the companies and their sectors is shown in Table 6.1. Inevitably, it is likely that some of the companies will have since graduated, been acquired, or had their quotation suspended or cancelled since August 1987.

Table 6.1 Summary of Non-Graduate Companies by Industrial Sector

Sector	Number	Percentage
Motors & Garages	2	3.3
Industrials	22	36.1
Drapery & Stores	11	18.0
Electrical	6	9.8
Paper & Print	6	9.8
Engineering	2	3.3
Food	2	3.3
Leisure	8	13.1
Brewing & Wines	2	3.3
Total	61	100.0

Hypothesis

These companies are ostensibly non-failed, but in the main have not moved into the full listing. Therefore we should expect to find:-

- Altman (1968, 1983) scores of >2.9 (2.7) and Taffler (1977, 1982) scores of >0.3 (>0.2)
- Any graduates will have consistently high Z scores.
- The average (μZ) should be lower than graduates both overall and if relevant, in the sectors.
- The value of the standard deviation may also be higher than that of the graduate, indicating a more erratic spread of scores.
- Any that have failed, or are possibly "at risk" will be down around or below the Altman 1.8 or Taffler Zero.

Initial Results

Inevitably, since the companies were chosen at random at August 1987, there will be changes in the sample from to year due to some entering after 1983 and others "leaving" before 1987. The summary of the results i.e means and standard deviations is shown in Table 6.2.

Table 6.2 Summary of Results

	Taffler					Altman				
Year	83	84	85	86	87	83	84	85	86	87
μ	.29	.35	.25	.25	.34	3.9	4.5	4.4	4.0	4.4
σ	.35	.26	.61	.55	.19	1.4	1.7	1.7	2.5	2.5
n	46	56	59	61	58	46	56	59	61	58

Comments upon the results in relation to the hypothesis

In the main, the first part of the hypothesis was correct, in that for each of the five years under

review, the average score was >2.9 and well above the revised score of 2.7. However, the Taffler 1985-86 scores which show averages below the 0.3 could be perceived to be in the risk area. However, if the Taffler (1982) cut-off of 0.2 is adopted, then the hypothesis is satisfied. All the Taffler scores show very high standard deviations reflecting a very wide range of results from this group. In contrast, the Altman scores are consistently above the 2.9 and are comparable to the scores of the graduates. (Table 6.3)

Turning to the four graduates, as might be expected, three of the four graduates within the sample all had consistently high scores, i.e Taffler >0.3 and Altman >2.9. The exception was the Parkfield Group, which had scores indicative of an "at risk" company both both Taffler and Altman in 1983 and Taffler again in 1984. The earlier scores may reflect Parkfield's performance as Parkfield Foundries, prior to its change in policy to a more diversified product range.

Table 6.3 makes the comparison with the Graduates. Again, the results in general confirmed the hypothesis. In four of the five years, (1983-86) the Taffler mean for the Graduates was greater than that of the Non-graduate companies and both the standard deviation and range for the Non-graduates were substantially larger than those for the Graduates. However, in 1987, the

Table 6.3 Comparison of Z-score Means
Graduates versus Non-Graduates

Author: Taffler Year	83	84	85	86	87
μG	.36	.39	.39	.40	.39
μNG	.29	.35	.25	.25	.36
(μG - μNG)	.07	.04	.14	.15	.03
σG	.17	.17	.17	.19	.25
σNG	.35	.26	.61	.55	.19
(σG - σNG)	-.18	-.09	-.44	-.36	.06
Range G	1.1	1.0	1.1	1.4	1.1
Range NG	2.6	1.7	5.6	4.4	1.0

Author: Altman Year	83	84	85	86	87
μG	4.4	4.6	4.7	4.7	4.7
μNG	3.9	4.5	4.4	4.0	4.5
(μG - μNG)	0.5	0.1	0.3	0.7	0.28
σG	1.9	1.8	1.8	2.1	2.1
σNG	1.4	1.7	1.7	2.5	2.5
(σG - σNG)	0.5	0.1	0.1	-0.4	-0.4
Range G	11.6	8.4	8.6	13.4	13.2
Range NG	6.7	8.6	8.4	22.0	15.3

two populations exhibited very similar results i.e. mean value was almost the same, a very narrow range and the value of σZG actually greater than that of σZNG. By contrast, the Altman scores were not quite as expected. While the values of μZG were consistently greater than that of μZNG, only in 1986 and 1987 were the values of σZG less than that of σZNG. Additionally, the ranges

also exhibited an erratic pattern. Only 1986 and 1987 were the Graduate ranges significantly lower than those of the Non-graduates. Thus, from this standpoint, the Taffler scores were more in keeping with the hypothesis. The Altman data tends to suggest that the Graduates may not be a suitable "successful" subsample for a discriminant analysis, i.e. the Altman Graduate profile is not significantly different from that of the Non-Graduate.

As regards the hypothesis concerning failures, the sample contained three companies which eventually can be classified as having failed. Although the correct classification of failure is the subject of chapter 7, it is worth commenting at this stage that two of the three failures exhibited warnings of danger with scores below the threshold and below any means but, apart from one instance, inside the value of $(\mu - \sigma)$. Their results are tabulated in Table 6.4.

Table 6.4 Failed Non-Graduate Company Scores compared with the Sample Mean

		Taffler					Altman				
Year		83	84	85	86	87	83	84	85	86	87
μ		.37	.37	.29	.25	.34	3.9	4.5	4.4	4.0	4.4
σ		.35	.26	.61	.55	.19	1.4	1.7	1.7	2.5	2.5
$(\mu - \sigma)$		.02	.11	-.32	-.3	.15	2.5	2.8	2.7	1.5	1.9
Company											
S7	B I Air	*	*	.2#	.3	.3	*	*	2.8#	3.5	3.6
S39	GodwinW	.42	.45	.41	-.01	.23	3.6	4.0	4.0	2.9	2.3
S59	Pineapp	.5	.21	-.05	**-.58+**	.29	4.6	2.2	**2.1+**	3.6	2.2

Note: # Score reflects performance prior to coming to listing.

+ Bold print identifies the one example of an ailing company plotting $<\mu Z$ and $(\sigma - \mu)Z$. It might be interesting to consider that they are different years.

Further analysis.

As with the Graduates, factor analysis was performed, and three cluster patterns were identified. Again, the main objective is to see if there is evidence of commonality between the two Z-score models. However, unlike the Graduates, there were no related patterns. The Taffler scores clustered for 1983-85, there was a cluster similarity between Taffler 1986 and Altman 1986, which was the only cluster that transcended the two models and the third showed a similarity between Altman 1983-85. (Table 6.5)

Table 6.5 Correlations and Cluster Patterns

Cluster Patterns

Author	Taffler	Factor 1	Factor 2	Factor 3
1983		.81786)	-.20342	.08028
1984		.89921)	-.02444	.21919
1985		.89292)	.02182	-.01734
1986		.10295	.88288	.03761
1987		.67293)-¦	.46086)-¦	.21671
	Altman			
1983		.19987 ¦	.15832 ¦	.78844)
1984		-.11893 ¦	.03625 ¦	.87505)
1985		.38951 ¦	-.10191 ¦	.72241)
1986		.11406 ¦	.96222 ¦	.01312
1987		.63587)-¦	.39375)-¦	.14233

Correlations Year:	1983	1984	1985	1986	1987
	0.2044	0.1540	0.4727	0.8256	0.7097

As might be expected from the cluster patterns, correlation results between the two models was also poor. Only 1986 and 1987 produced significant correlations of .8256 and .7097 respectively. In the light of the clustering between Altman and Taffler in 1986, the high correlation can be regarded as almost inevitable. The factor 1 cluster did however show a result of >0.6 for 1987 and factor 2 was >0.4 to give some support for the high correlation for 1987. (Table 6.5)

Misclassifications

As with the graduates, an analysis was undertaken to see if there were any companies ostensibly misclassified, on the assumption that if the score was either <0.3 (Taffler 1977) or <2.9 (Altman 1968) then they were potentially at risk or potential failures. Since the original hypothesis about the Non-graduate population was that they should be successful companies, correct classification must imply scores indicative of success. Table 6.6 summarises the results.

From the table, it will be apparant that the Altman score seems to be marginally more reliable at confirming these USM companies as potentially unlikely to fail. However, if the emphasis is switched from a hypothesis assuming success and hence non-failure Z-

score ratings to appraising the Z-score per se further analysis of the unexpected results revealed some noteworthy patterns. In all, 32 companies revealed scores which were below the expected Taffler's 0.3 or Altman 2.9 in at least one year. However, only 19 were identified below the Altman 2.9, and only one, Debfor/Sherwood was so identified by Altman alone. Of

Table 6.6 Summary of Expected Results

Taffler	1983	1984	1985	1986	1987	
n	46	56	59	61	58	
Success >0.3	30	43	40	41	41	
"At risk" >0 - 0.3	14	11	14	14	14	
Potential failures <0	2	2	5	6	3	
% correct	65	77	68	67	71	μ = 69.6%
Altman						
Success >2.9	36	51	48	50	46	
"At risk" >1.8 - <2.9	8	4	9	7	10	
Potential failures<1.8	2	1	2	4	2	
% correct	78	91	81	82	79	μ = 82.2%

the 32, 12 that were "below the cut-off" had scores based on data derived from before they had entered the USM further vindicating the Hutchinson, Meric, Meric (1988) conclusions about the favourable impact of coming to the listings upon corporate performance. At

the same time, a further 6 were identified as eventually needing reorganisation or ultimately did not survive. Thus, these can be regarded as having been correctly classified as possible failures, or at least exhibiting early symptoms of possible future trouble. From this additional background knowledge, we can now reassess the performance of the Z-score models in the context of correct classification of the sample companies.

The Reassessment

To make the reassessment, three adjustments are required. First, since Taffler (1982) indicates a 0.2 cut-off, it becomes pertinent reintroduce to the assessment companies in the band 0.2 - 0.3, since Taffler perceives such companies as displaying the characteristics of companies that have not failed. This adjustment has also been incorporated into Table 6.7, and makes a substantial contribution to the improved performance. Likewise, an assessment can be made of the consequences of using Altman's revised upper cut-off of 2.7. Secondly, there has to be consideration of data derived from prior to USM entry. Since it was noted in Chapter 4 that future prospects were as important as historic performance, it is likely that companies before entering may have low Z-scores. Since the Hutchinson Meric Meric study revealed that firms

entering the USM derived considerable gains and boosts to their performance, and this thesis is about the contribution of USM listed companies, then, as with the Graduates, it becomes pertinent to add back results do not reflect the benefit of joining the USM, irrespective of future outcomes. Thirdly, consideration must be given to correct identification. The score may be below the cut-off line because it is correctly classifying a company that is at risk or heading towards failure. Equally, a misclassification in this area must count against the overall performance.

Table 6.7 Reassessment of Taffler Z-score performance

Year	83	84	85	86	87	
n	46	56	59	61	58	
Number correct (per hypothesis)	30	43	40	41	41	
Add back pre USM (HMM)	10	4	4	1	1	
Add revised (1982) cut-off	2	3	2	6	5	
Add failures/ reorganised	2	2	4	4	2	
Deduct failure (not recognised)				(1)	(1)	
Revised total	44	52	50	51	48	
Revised %	96	93	85	84	83	μ = 88.1%

The failures/reorganised category are those companies which scored below 0 and eventually collapsed and/or needed a reorganisation. The non-recognised failure is British Island Airways, where the Z-score gave no

indication of potential problems up to the end of 1987. Indeed, further analysis of British Island Airways after 1987 only reveals a deterioration of scores into the grey areas somewhat vindicates the Ohlson (1980) and Watts and Zimmerman (1986) criticism of early research into Z-score methodology. The assumption that failed company data are available one year before the final collapse is erroneous, and has lead to overstating of the accuracy of the prediction results. Companies which required a reorganisation and/or failed which moved, albeit temporarily, back into the grey area, are only shown when they are in the failure zone. Among the remaining data, are two further companies, both which needed eventual reorganisation and one even having its dealings temporarily suspended, but never scoring below the zero cut-off. Thus, where they are in the failure zone and eventually failed, they can be regarded as potential failures, and the Z-score has given an early indication.

There is one final aspect relevant to the assessment of the Taffler score in the context of the USM companies and the initial hypothesis. This is that based on the 0.3 cut-off, there was a substantial number of ostensibly misclassified results in certain major sectors. Revising the cut-off down to the 1982 0.2 had little impact upon this pattern. Since the three

sectors involved embrace 25 (41%) of the 61 companies, i.e. 41% of the total, this may call into question the validity of using a model which purports to be universally applicable on a particular sector within a particular financial listings market. However, it should also be noted, that while these three sectors have made a significant impact upon the growth of the USM, (20.5% of all entrants up to April 1986,) they also have a tendency not to be among the Graduates. Table 6.8 summarises the results derived from the total number of scores calculated for the individual companies over the five year period, and the proportion of misclassifications with each sector.

Table 6.8 Major Sector Misclassifications - Taffler

Sector	Total Number of Companies	Total Number of Scores	Misclassifying Scores Number	Misclassifying Scores %
Drapery & S	11	47	11	23.4
Paper &Print	6	30	8	26.7
Leisure	8	35	23	65.7

We can now move onto the Altman re-assessment.(Table 6.9)

It will be observed from Table 6.9 that, apart from 1983, where the improvement is due to adjusting for companies that had not yet entered the USM, there is no marked change. Furthermore, Altman does not so clearly classify the apparent failures, which may give some support to the Inman (1982) view and indeed to

Table 6.9 Re-assessment of the Altman Z-score Performance

Year	83	84	85	86	87	
n	46	56	59	61	58	
No correct (per hypothesis)	36	51	48	50	46	
Add Pre-USM entry	4	1	1	1	1	
Revised cut-off			2	3	2	
Failures/ reorganized		1	1	1	1	
Deduct failure (not recognised)	*	*	*	(1)	(1)	
Revised total	40	52	52	54	49	
Revised %	87	93	88	89	84	μ = 88.2%

to Argenti's (1976, 1983) earlier analysis of Rolls-Royce. What is perhaps more noticeable when Altman is assessed and compared with the Taffler results in both Tables 6.7 and 6.8 is that Altman confirmed the hypothesis about scores being commensurate with success for the Drapery & Stores sector, confirmed the Taffler pattern of a high number of potential mis-classifications for the Paper and Print sector and halved the number in the Leisure sector. In complete contrast, of the 98 readings in the large industrial sector, 14 (14.29%) were ostensibly misclassifications. More to the point, what appears to emerge, is a significant number of companies that appear to keep going in the Altman grey zone, making

identification of failures somewhat difficult. What is evident, that from the sample analysed here, is that the early warning claims may be somewhat suspect.

Preliminary conclusion:

It would appear that both models can reasonably classify the winners, with Altman having the edge. Overall classification would seem to be reasonable, but the grey area is a problem and early warning claims are highly suspect. The three companies "performance" *vis-a-vis* the scores is summarised in Table 6.10. The table shows that British Island Airways gave the first indications in December 1988. Since published accounts do not appear on the year end date, the lead time

Table 6.10 Assessment of Failure Prediction

Author: Taffler 1977/1982									
Company/Year		83	84	85	86	87	88	89	90
S7	B I Airways	*	*	.2#	.3	.3	.1	*	!
S39	Godwin W	.42	.45	.41	-.01	.23	*	!	
S59	Pineapple	.5	.21	**-.05**	**-.58**	.29	*	*	
Altman 1968 and revised									
S7	B I Airways	*	*	2.8#	3.5	3.6	2.4	*	!
S39	Godwin W	3.6	4.0	4.0	2.9	2.3	*	!	
S59	Pineapple	4.6	**2.2**	**2.1**	3.6	2.2	*	*	

Notes ! Indicates year of collapse or first admission of trouble i.e. hoping to find a rescuer.

* Indicates data not available, or in the case of Pineapple, irrelevant.

\# Result reflects the HMM conclusions.

between date of accounts and eventual collapse in this case was about 14 months with both models. All was ostensibly well during 1988. Godwin Warren gave first warnings in 1986 year end accounts, i.e. sometime during 1987. Taffler was below cut-off on all measures, and Altman showed a dramatic change. The 1987 figures reinforced the picture. With liquidators called in during February 1989, the leadtime was, at best, 26 months. Pineapple turned in bad results, and hence gave warnings, at the end of 1985. The company responded and diversified away from total Leisure to be reclassified under Paper & Publishing by early 1988. If, in keeping with the Argenti (1976, 1983) viewpoint, the effect of the response is the critical criterion criterion, in that the company either survives or fails, then Pineapple had a two year warning. Another view might be that the scores give a lead warning which may result in the correct managerial response. Improved subsequent scores may confirm this. However, ultimate failure suggests that even a correct Argenti-style response can prove to be the proverbial "too little, too late." Whatever, only having three examples makes it difficult to come to any realistic conclusions as to whether the early warnings are reliable, or the lead warning times as long as is claimed.

CHAPTER 7 SUSPENSIONS AND COLLAPSES.

As of 31 December 1987, 589 companies had come to the Unlisted Securities Market. Of that 589, 28 (a mere 4.75%) had been categorised as suspended or had had their quotation cancelled. Since this definition is rather wide, it is worth noting that at the end of 1988, the number was only 26, since at least four of those classified as "suspended" in 1987, had been reorganised and had re-entered the market during 1988. Inevitably, others had joined this group. The big change from 1987 to 1988 was in companies "re-organised." This had increased from 10 in 1987 to 24 at the end of 1988 (Table 7.1) and to 31 by the late autumn of 1989. Even the 26 have not been entirely deleted from the listings, at least eight are still extant in some form.

This must reinforce the Argenti (1976, 1983) view. Since Taffler (1982) argues that companies are only displaying symptoms of collapse, the the Argenti view of possessing adequate depth of management to respond is valid. Collapse in the sense of final bankruptcy or failure may result from an inherent inability to respond or a lack of confidence on the part of third parties to respond to the declared symptoms. By contrast, it should not be forgotten that while a reorganisation may avoid collapse, it can still imply a substantial if not total loss in equity for the current shareholders.

Methodology of Approach

For this part of the testing exercise, 20 companies have been selected for analysis. The reason for the number and choice of company is outlined below. This

Table 7.1 Industry Category of USM Companies Suspended or Cancelled 1987-1988

Category	1987		1988	
	NUMBER	%	Number	%
Building	1	3.57	1	3.87
Drapery	3	10.72	2	7.69
Electricals	4	14.29	5	19.20
Food	1	3.57	-	
Industrials	11	39.29	9	34.60
Leisure	2	7.14	2	7.69
Paper etc	1	3.57	1	3.87
Property	2	7.14	2	7.69*
Trusts etc	1	3.57	1	3.87*
Oil & Gas	2	7.14	3	11.52*
TOTAL	28	100.00	26	100.00

Source: KPMG Peat Marwick McLintock USM Survey December 1987-88.

* Indicates Industrial Sector excluded from the analysis.

compares with the 24 identified by Wood and Piesse and are listed in Table 7.2 and can be categorised as belonging to four specific groupings.

Explanation of the choice of 20

In table 7.2 below, the first nine are drawn from the 28 companies who were in the suspended or cancelled

Table 7.2 Twenty Companies Failed/Cancelled/Suspended

No	Name	Entry Year	Details
1	Adam Leisure	1983	Cancelled 1987 Reorganised as as Hawthorn Leslie
2*	Castle G B	1983	Cancelled 1987
3	Promotions House	1983	Cancelled 1986
4	Access Satellite	1982	Ostensibly OK Cancelled 1988
5	Ecobric	1982	Cancelled 1988
6	Imtec	1983	Still extant
7	Metal Science	1983	Cancelled 1988
8	Mnemos	1983	Cancelled 1989
9*	Xyllyx	1984	Suspended 1985
10	B I Airways	1986	Collapsed 1990
11	Godwin Warren	1983	In liquidation 1989
12	Pineapple/ /Prospective	1982	Reorganised Acquired/Rescued winter 1989/90
13	Anglo-Nordic	1982	$425 merger
14	Humberside Electronics	1981	Reorganised Quote suspended 1988, and cancelled 1989.
15	Wm Morris/Lincoln	1984	Re-organised 1988
16	Pavion	1985	Under administrators 1990
17	Federated Housing	1983	Quoted suspended Receiver appointed 1990
18	Leisure Industries	1985	In receivership 1990 Rescued in takeover 1990
19	Midsummer Inn	1982	Facing a predator
20	MBS	1982	Reported as struggling in financial press.

* Identified as suspended in the April 1986 KPMG Peat Marwick McLintock USM Survey

category outlined by the Peat Marwicks Quarterly survey in December 1987. Some have been deleted from this group because the suspension was for legal reasons other than potential collapse. In selecting the the companies for analysis, availability of data from either the Hambro Company Guide and or Companies House was an important consideration. In addition, the cancellation or suspension had to have taken place during the five year period under review or immediately after it. Thus the eleven companies who had had their quotes suspended/cancelled in the period 1980-1982 are immediately excluded from the listed 31. However, four additional suspensions or cancellations in the period January 1988 to September 1989 are included bringing the total to 13. This includes two post 1987 collapses, a $425 merger and a reorganisation of a company which would have otherwise failed.

The second group, Nos 14-16, are companies derived from the Non-graduate Sample (Chapter 6) who were found to have poor Z-scores. This group initally consisted of 7 companies, of which the three selected have either collapsed or had to undertake a major reorganisation. The other four companies are still listed as on-going and must be deemed to be non-failures.

Numbers 17 and 18 are graduates where problems have arisen since the end of the period under review. These

are brought in to test the early warning claims of the Z-score models. As with the Non-graduate group, there are a number of graduates with poor Z-score showings that are still extant in the listings.

The final group, Nos 19 and 20 are the result of out-of-sample analysis. The surveys and reports were scanned for any other companies who had been excluded from any other analysis, but were found to have been reorganised. In adopting this approach, the precedent established by Wood and Piesse has been followed. Like Wood and Piesse, the models will be tested on these companies to see if the classifications are correct, and if there is a reasonable length of warning. The two companies identified were MBS plc, formerly Micro-Business Systems plc, and Midsummer Leisure plc. The former company has had a poor record for growth, profit and liquidity with losses turned in in 1985 1988/89. Turnover actually fell in the years 1987-89 and there has been no dividend since 1987. The Hambro Performance Rankings Guide gave the company some very poor rankings during 1987/88. On the basis of indicators suggested by Robertson, Lau and Gentry, the company should be a prime candidate for failure. Midsummer Leisure was included because of very poor (< 0.2) Taffler scores in the years 1983-87. In addition, the Hambro Performance Rankings Guide gave it some very poor rankings for productivity, gearing and liquidity in 1987/88. It was

thus perceived as at least exhibiting many of the characteristics of companies that had failed in the past.

Taking the Group as a whole, it may be significant that of those 20, 15 date from the early euphoric years of the USM, i.e 1980 through 1983. In addition, to be consistent with the principle laid down in the study of both the Graduates and the Non-Graduates, (Chapters 5 and 6) the Insurance, Property, Financial Services and Oil & Gas sectors have been excluded. Thus, of the original 31, this excludes 5 (6 as at end 1988) companies from these sectors had fallen into the category of having been suspended or had their quotation cancelled. (Table 7.1)

Hypothesis

Since this is an essentially empirical study, we would expect to find:

(i) All 20 initially to be below the Altman 1.8 score. A second review will be undertaken to see if the Argenti modifications with a revised lower cut-off of 1.5 improve the results. It will also be interesting to see of any of Altman's prediction patterns are valid for the years prior to the suspension or cancellation. This is likely to prove difficult since many of the companies will have only been listed within a relatively short time and

would not have achieved the listing had their previous results been suspect. Thus, the profile of such a company is one of initial apparent success followed by fairly rapid deterioration.

(ii) Taffler's index to show (a) at least negative figures.

(b) a score <0.2 based on the 1982 conclusions.

Again, the comments made in regard to Altman in [i] above, and the duration of trading on the USM still apply.

The results from the 20 companies were classified as:-

(i) likely to fail,

(ii) "at risk" because they are in the "grey area",

(iii) misclassification.

A misclassification could be for two reasons. Firstly, due to Z-scores giving either no indication of the doom to come or a Z-scores predicting doom in a company that had still survived. Secondly, the data may relate to the period prior to entry to the USM, where a pattern of low scores has already been observed, (Chapters 5 and 6) and from the Hutchinson Meric Meric 1988 study, where entry to the USM is followed by a substantial improvement in performance and hence Z-score.

The crude results suggest that apart from the Taffler 1982 revision, neither model is a very good predictor <u>per se</u> of failure. It thus becomes pertinent to measure

how soon the warnings came. To do this, the date of the "critical event" i.e. major re-organisation or suspension

Table 7.3 Failure Classification

Z-Score Model		Failed	At Risk	Misclassification
Altman 68	n =	9	5	6
	% =	45	25	30*
Altman/Argenti	n =	6	8	6
	% =	30	40	30*
Taffler	n =	6	9	5
	% =	30	45	25**
Taffler 82	n =	12	3	5
	% =	60	15	25**

*/** Contains one/two apparent misclassifications which related to years prior to entry to the USM.(HMM)

has to be identified, and the scores analysed for the preceding years.

However, in identifying this "critical event", it must be recognised that the company may have ceased trading at an earlier date, and so the last year in which accounts were prepared will become important. Two dates can possibly be identified, (i) the first year to show an "at risk" or grey area score, and (ii) the first year to show a likely to collapse score. In addition, only 18 companies can be included in this analysis, since two are still ostensibly non-failures. The results are shown in Table 7.4. In the table, the differences in the value of Σn are due to some

companies having an early warning "at risk" score but no failure score, and vice versa.

The obvious pattern that seems apparent from the table below is the extremely erratic pattern of prediction timings. In addition, the warnings of failure appear in both cases to be too late, a year at best, and often

Table 7.4 Analysis of Length of Warning

Z-Score Model	Altman				Taffler			
Time (Years)	At Risk		Failure		At Risk		Failure	
	n	%*	n	%*	n	%*	n	%*
5	3	23.1	1	5.9	4	57.1	2	13.3
4	1	7.6	1	5.9	1	14.3	1	6.7
3	3	23.1	3	17.6			1	6.7
2	2	15.4	1	5.9			3	20.0
1	2	15.4	4	23.5			6	40.0
0	2	15.4	7	41.2	2	28.6	2	13.3
Σn	13	100.0	17	100.0	7	100.0	15	100.0

* % indicates the proportion of total identified companies given a warning and the length of that warning, i.e. only 5.9% received a five year warning of collapse on the Altman basis.

less than a year before the failure is declared. Such findings would seem to vindicate the views expressed by Gupta, Watts and Zimmerman and Wood and Piesse. In addition, the view expressed by Kharbanda and Stallworthy, that very early warnings are needed, if the models are to be credible, they must give reliable warnings well beforehand.

Implications for Theory

Before drawing any conclusions from this chapter and the two preceding it, consideration must be given to testing the contribution of any attempts at developing an underlying theory. The twenty companies tested for classification by Z-score analysis will now be similarly appraised on the basis of the ideas put forward by Robertson, Lau and Gentry. This will enable a clearer profile to be developed of a perceived ailing company, and as such, will replicate the methodology suggested by Argenti. This will be particularly useful from the standpoint that while Table 7.3 did not give significant unequivocal conclusions about failure, a significant proportion of the companies were not obviously successful, and certainly warrant further analysis. Table 7.5 summaries the results of analysising the twenty companies in the light of the four criteria advanced by Robertson, and the second stage of the Lau continuum.

Some of these results are inevitable. Since both the Altman and the Taffler models rely heavily upon profitability or the lack of it, it is almost inevitable that Robertson's declining profitability should feature as the most dominant criterion. In addition, of the four companies that did not conform with this criterion as at the end of 1987, two displayed little indication of what was to impending. The other two

Table 7.5 Company Profile Analysis

Criterion / Company	Robertson Trading Stability	Profitability	Declining Working Capital	Increased Borrowing	Lau/Gentry Dividend Passed
1 Adam L	V	V	V	-	V
2 Castle	V	V	V	-	V
3 PromotH					
4 Access				V	
5 Ecobric	V	V	V	V	V
6 Imtec	V	V	V	-	V
7 MetalSc		V	V	-	V
8 Mnemos		V	V		
9 Xyllyx		V	V	-	V
10*BIAir		V	V	V	V*
11 Godwin		V		V	
12 Pine		V		V	V
13 A Nord	V	V	V		V
14 Humber		V			V
15Lincoln	V	V	V		V
16 Pavion	V	V	V		V
17FedHous	**			V	
18Leisure		V		V	
19Midsumm				V	
20 MBS	V	V	V	-	V
Total	8	16	12	8	13
%	40	80	60	40	65

Source: Hambro Company Guide

* Data includes post 1987 events. The 1988 dividend was not passed but substantially reduced.

** No indication at all of impending trouble.

were Access Satellite which was eventually suspended for no obvious financial performance related reason, and Promotions House, whose quotation was likelwise cancelled for reasons that included those other than financial standing and performance.

The Lau/Gentry view about dividends appear to be vindicated since this ranks second. While this could be regarded as sound cashflow management to pass dividends and within the UK avoid the complications of Advanced Corporation Tax, the work of Gentry et al, and the conclusions of the Lau continuum analysis indicate that it may be preceived as an ultimate vote of confidence.

Decline in working capital was defined using the gross working capital of Altman. That this was over 50% calls into question the conclusions of Tamari (1978) who warned about the possibility of working captial **actually** increasing because of an inability to turn over inventory and reduced credit control in order to obtain sales at any price. That every company who registered a decline in trading stability also recorded a decline in working capital may suggest that inventories and receivables are at least being managed in accordance with the revised turnover levels. Conversely, that seven of the companies did not satisfy both the trading stability and the declining working capital criteria may give some credance to the Tamari viewpoint.

It may be worth adding that the Tamari viewpoint may be reinforced by the low proportion of companies satisfying the trading stability criterion anyway. However, what may be peculiar to the USM type of company is the low proportion of companies increasing their borrowing. From the profile analysis in Chapter 4, it is evident that companies frequently tend come to the USM on order to raise additional external equity for the specific purpose to reduce borrowings. As a result, there is a marked tendency towards low gearing. What may be more interesting is that the one graduate company that eventually failed in 1990, only satisfied this criterion in 1987, while the three Leisure sector comapnies all showed dramtic increases in borrowings. In the light of the changing UK economy, and high interest rates, it may be that this criterion will feature in future collapses. (Chapter 9)

Problem of Sample Size

The inherent problem of any study into failure is the small number of actual failures. It has already been noted that in the period 1980-1989 only 31 companies have had their quotation suspended/cancelled out of 727 entries into the listing, a cumulative percentage of 4.3%. Although others have been suspended/cancelled since September 1989, the percentage would appear to be below the Taffler (1982) and Altman et al (1977) generalised failure expectation of 10%. and below the general annual

failure rate of 1%. This makes for very small samples, and thus any attempts at generalisation difficult. Table 7.6 summarises the pattern. In such a situation, the only tentative conclusion that might be drawn is that USM companies may have a greater resiliance to failure, may be better managed, or have an inherent ability to inspire confidence.

Table 7.6 Pattern of Suspensions/Collapses

Year of Entry	Number of Entrants	Cumulative Number	Suspended/ Cancelled*	Cumulative Percentage
1980	23	23	3	13
1981	60	83	7	8.4
1982	63	146	11	7.5
1983	85	231	19	8.2
1984	98	329	22	6.7
1985	98	427	24	5.6
1986	90	517	26	5.0
1987	72	589	27	4.6
1988	87	676	29	4.2
1989**	51	727	31	4.3

Source:
KPMG Peat Marwick McLintock USM Survey September 1989

* Cumulative to date
** Up to September 1989

Conclusions

We are now in position to draw some conclusions about the performance of the models in classifying USM companies. From chapter 5, both models adequately

classified the average graduates as successful non-failing companies companies, but there were individual graduates who had poor Z-score results.

Among the warnings, both Anglo-Nordic and Leisure Investments were correctly classified but the other graduates with poor scores, namely Oceonics and Quadrant, were still on-going as at May 1990. None of the graduates in the grey or warning zone had shown any symptoms of further deterioration. There was no warning evident of the problems that would eventually face Federated Housing and Midsummer Leisure.

Among the non-graduates, a more erratic pattern of results was observed. Non-failures, were in the main, correctly classified, but the success rate on warnings and failures was indifferent. There was little warning up to 1987 of the future for British Island Airways, and only a grey area warning in 1986-87 for Godwin Warren. Despite continuing losses up to end 1988, International Media (Formerly Entertainment Production Services), Bio-Isolates (losses and poor score up to 1987) and Greenwich Communication (losses and a re-organisation) continue to survive. In short, seven companies exhibited poor Z-scores, but only three actually could be described as having failed. Thus, on the failure side, the models are not very reliable since they do not take into account corporate resiliance, the culture of USM companies which

may contribute to an inherent ability to maintain confidence. This reinforces the Lev and Argenti view, that failure is not entirely the result of events that can be measured in terms of financial criteria.

Of the 20 recognised "failures", Table 7.3 indicates substantial proportions of mis-classifications, and where there are correct classifications, the timing i.e the length of warning was too short. Such results vindicate the view of Ohlson (1980) that earlier models exaggerated their accuracy, and again that data other than pure accounting data may be needed. (Watts and Zimmerman 1986, c/f Argenti 1977) At best, the conclusion must be that the data and the models are useful but other data is also required. The small sample, and high error rate, especially in length of warning, also calls into question to some extent the value of the models. It must be concluded that at best, they give warnings, and it is a function of the calibre of the management as to whether the warnings are headed and the company ultimately survives.

The Robertson/Lau/Gentry grid (Table 7.5) gives a useful indicator, albeit with an element of stating the obvious. 16, i.e 80% of the companies identified as exhibiting failure symptoms had declining profits. This vindicates the Beaver view of the ability to generate cash is vital to long term survival. The models both placed major

emphasis on the ability to generate profit and hence cash. With the largest weighting, falling profit or losses are going to influence the final score. Equally, the choice of a working capital ratio, indicative of the ability to cover liabilities asset and possibly inspire confidence is also important. However, Altman ranked this ratio after his retained earnings ratio, which emphasises the historic ability to build up reserves as a result of sustained profitability. Indeed, opinion is divided in the literature as to the merit of such a ratio, but clearly, if this ratio is in decline, there is a warning being given. That a decline in this area should be second to a passing of the dividend may vindicate the view of those who discount working capital based ratios. However, the passing of a dividend, in order to conserve cash, (Lau 1986, Gentry et al) does have a serious impact upon confidence and in a quoted company environment, will ultimately effect the share price. This will thus cause the market to revise down its longterm view of a company's performance. This may well add further evidence to the view that accounting based models, however successful they may claim to be, do not appear to out predict the market, and that the market has identified its winners and loosers long before any accounting based model has produced a warning. (Chapter 9, Westerfield 1970, Aharony, Jones and Swary 1980)

CHAPTER 8 THE USE OF SELECTED RATIOS IN DISCRIMINANT ANALYSIS

Now that the evaluation of the Altman and Taffler Z-score models in relation to the USM companies has been completed, it becomes pertinent to ascertain if any individual ratios are better discriminators than an MDA model. This will be done using material selected from the data that has already formed the basis of the analysis in chapters 5-7. The discriminant analysis methodology employed will be similar to that performed by Houghton and Woodliff (1987). From chapter 2 above, it will be recalled that discriminant analysis enables mutually exclusive groups to be classified on the basis of a set of characteristics and identify which of those characteristics or disriminating variables are the most powerful set of discriminators and develop a procedure for predicting group membership for cases where membership is at present undetermined (Klecka 1980, Coshall 1990).

The Methodology of Discriminant Analysis

Before commencing the actual analysis, a brief discussion on the methodology of discriminant analysis is necessary to help in the understanding of the final results. Discriminant analysis produces linear combinations of the independent or predictor variables and uses them as a basis for classifying cases into one of the groups. In the case of this thesis, the groups

will be the successful USM companies, companies perceived as being "at risk", and potential failures. For discriminant analysis to be "optimal" in the sense that the probability of a misclassification is minimised, the variables should be samples from normal populations. However, there is evidence that even inthe case of dichotomous variables (e.g. of the "yes"/"no" type) the linear discriminant function often performs reasonably well (Coshall 1990).

In discriminant analysis and other multivariate statistical procedures, the emphasis is on analysing the variables together. By considering the variables together, we are able to incorporate information about their relationships. In discriminant analysis, a linear combination of the independent or predictor variables is formed and serves as a basis for assigning cases to groups. This is the basis of the models such as the Altman and Taffler models already discussed and appraised. The linear discriminant equation is:

$$D = B1X1 + B2X2 + ...BpXp$$

where Xi are the values of the independent variables and the Bi are the coefficients estimated from the data. If this linear function is to distinguish between groups of successful and unsuccessful companies, these two groups will differ in their D scores which are referred to as discriminant scores. Hence, the values

of Bi are computed so that the values of the discriminant function differ as much as possible between the groups. The Bi are called discriminant function coefficients. The SSPS/PC package used for this analysis reports the value of Bi in standardised form i.e. all the variables are first standardised to have a zero mean and unit variance. Using the D scores, SSPS/PC computes the probabilities of each case belonging to the various groups identified in the thesis. Finally, it should be emphasised that only one discriminant function is necessary to distinguish between two groups, two discriminant functions for three groups etc. This will be relevant in the approach to the analysis, since we will first analyse on the basis of straightforward success/fail and then introduce the "at risk" element as a third group for a second phase of analysis.

Discriminant analysis produces three statistics that assess the adequacy of any discrimination achieved. These are:

- The **square of the canonical correlation** which represents the proportion of total variance in the discriminant scores explained by the differences between the two groups.
- **Eigenvalues** which represent the ratio of between groups sums of squares and within groups of sums of

squares. Conventionally, an eigenvalue of ≥1 is regarded as a satisfactory result.

- **Wilks' lambda (/\)** which is the proportion of the total variance in the discriminant scores not explained by the differences among groups.

In the context of this thesis, therefore, the use of such discriminant analysis will enable the companies selected to be classified according to the gathered variables and to identify and rank the most significant ratios used in the classification. However, one important principle must be emphasised. This is that the classification is based on exhibited characteristics, i.e companies are discriminated on the basis of exhibiting characteristics of a failed or successful company. Thus this is similar to the Taffler (1977, 1982) conclusion and the view expressed by Johnson (1970) that results showed that a company was exhibiting the characteristics which had led to failure of other companies in the past, or that the ratios were substantially different from other successful companies, and hence more in keeping with companies that had eventually failed.

Approach to the Analysis

For the purpose of the analysis, thirteen accounting ratios were identified as possible discriminating variables. These are listed in Table 8.1. This choice

of thirteen ratios compares with Tamari's 10, (1964)

Table 8.1 Summary of Choice of Ratios

Ratio	Worker	Dates
Working capital/Total assets	Altman, Blum	1968, 1969
Retained earnings/Total assets	Altman	1968
Profit before tax/Total assets	Altman	1968
	Beaver	1967
	Robertson	1983
	Zimmer	1980
	Houghton & Woodliff	1987
Market value/Total debt	Altman	1968
Sales/Total assets	Altman**	1968
Profit before tax/Current liabilities	Taffler	1977, 1982
	Edminster	1972
Working capital/Total debt	Taffler	1977, 1982
Current liablities/total assets	Taffler	1977, 1982
No credit interval/Operating costs	Taffler	1977, 1982
	Beaver	1967
Cash flow/Total debt****	Beaver, Blum	1967, 1969
Total debt/Total assets	Beaver	1967
Current ratio	Tamari***	1964
Acid test ratio	Tamari	1964
	Edminster	1972
	Zimmer	1980
	Houghton & Woodliffe	1987

Notes:

* Both Altman and Robertson give this maximum weighting.

** Robertson has a similar ratio, and Edminster also uses a sales based ratio.

*** Robertson's $\frac{\text{Liquid assets - Bank overdraft}}{\text{Creditors}}$ is similar in concept to this.

**** Both Zimmer and Houghton and Woodliff use the reciprocal of this ratio i.e $\frac{\text{Total Debt}}{\text{Cashflow}}$

Altman's original 22 (1968), Edminster's 19 (1972), Blum's 12 (1969) and Beaver's 30. In selecting the ratios, it will be evident that the ratios finally selected by both Altman and Taffler have been included, along with Beaver's **cashflow/total debt** and**total debt/total assets** and the traditional **current ratio** and **acid test ratio** favoured by Tamari (1964), Zimmer (1980) and Houghton and Woodliff (1987). This approach enables a wide range of discriminating ratios to be tested. However, it should be added that despite the views expressed by Lau (1986), no dividend based ratio was included. In the light of the Houghton and Woodliff conclusions, it was felt that such a ratio in this context was likely to be inconclusive.

As with the evaluation of the Altman and Taffler models, the five year review period (1983-1987) was examined. As before, the number of companies varies slightly, due to entry into the listings after 1983 and/or exit before 1987 due to acquisition or demise. Table 8.2 lists the sample number of companies used for each of the five years under review. The Graduates and and the Non-graduates represent populations of known successful companies, while those that have failed (i.e. quotation suspended/cancelled) or are considered at risk, are perceived as unsuccessful. The ratios will then discriminate between them.

Table 8.2 The Numbers of Companies Used in the Exercise

Year	1983	1984	1985	1986	1987
Graduates	32	33	33	33	33
Non-graduates	12	14	14	14	14
Failed	7	11	11	9	5
"At Risk"	13	14	16	16	14
Σ	64	72	74	72	66

From Table 8.2, two points need clarifying. Primarily, the number of Graduates and Non-graduates used in this MDA research was smaller than that in chapters 5 and 6 as only consistent "good performers" over the five year period under review were included in the "successful" group. This produced a population of 33 Graduates and 14 Non-graduates characterised by consistently good performance defined as consistent growth in turnover and profit performance over the period under review.

Secondly, in view of the criticisms made by Eisenbeis (1977), the

(1977), the term "At Risk" may need some clarification. They are not companies that give rise to doubts in classification. Rather, in view of Altman's identification of a "grey area", a third similar such distinct category was felt to be needed. As such, the "at risk" category will include:-

(1) - companies that have needed to go through some form of managerial reorganisation. Where this was

successful, and the company returned to growth and profit, it was excluded from any subsequent analysis. This enabled the testing of the Argenti (1976, 1983) view that survival depends on good management decisions. If, however, performance did not improve, then the company was deemed to be still at risk, and was retained in the analysis. This group also included a small number of out of sample companies reported as having having been reorganised either during the five year period under review or during 1988.

(2) - have displayed bad Z scores in the earlier Z-score analysis but are still in existence.

(3) - are still extant, but are listed as suspended.

Thus, by adopting this approach, (i.e. identifying economic criteria) we are paralleling the views expressed by Robertson (1984), and attempting to respond to the suggestions of Lev (1974).

Methodology of Approach

The data were analysed using Lotus123 and SPSS/PC computer packages. For each of the five years reviewed, the data were run through the procedure twice, first

without the 14 "at risk" companies and secondly including them. This was done to identify firstly simple success/and failure, comparing known successes and known failures and to see if the companies were

correctly classified. Secondly, the "at risk" category was then brought in to see how the analysis procedure would classify the companies.

Success/Failure

Since 1985 is the mid-point year of the review period, it will be regarded as the base year. These results will be examined in detail, (Table 8.3) and the other years compared.

Table 8.3 Summary of Results 1985

Eigenvalue	Canonical Correlation	Wilks' Lambda	Chi Square	DF	Significance (p)
2.431	0.8417	0.2915	59.79	13	0.000

Pooled within groups correlation between discriminating variables and canonical discriminant functions

Discriminating Variable	Function
ALT33	.524
TAFF53	.448
BEAVERCFD	.444
ALT14	**.345**
ALT10	.203
CR	.101
ALT12	.056
TAFF13	.034
ALT06	.035
BEAVERDA	.027
TAFF18	.025
TAFF16	.003
ATR	.002

The canonical correlation squared indicates that 71% of the variance in discriminate scores is explained by the difference between groups. The standardised linear equation which established the scores was:

Dstand = - 0.138(ALT12) + 0.036(ALT14) - 3.127(ALT33)
+ 0.392(ALT06) - 0.407(ALT10) - 4.328(TAFF53)
+ 1.454(TAFF13) - 0.31(TAFF18) + 0.888(TAFF16)
- 2.123(BEAVCFD) + 1.4(BEAVDA) - 1.932(CR) -
0.389(ATR)

The variables designated ALT12, TAFF53 etc., refer to the original Altman and Taffler ratios, (Chapter 2) identified by their original discriminant function coefficients as follows:-

Altman: ALT12 = Working capital:Total assets

ALT14 = Retained earnings:Total assets

ALT33 = Earnings before tax:Total assets

ALT06 = Market value of equity:Book value of total debt

ALT10 = Sales:Total assets.

Taffler: TAFF53 = Earnings before tax:Current liabilities

TAFF13 = Current assets:Total liabilities

TAFF18 = Current liabilities:Total assets

TAFF16 = No credit interval

The four additional variables are:-

BEAVCFD = Beaver's Cashflow/Total Debt

BEAVDA = Beaver's Total Debt/Total Assets

CR = Current Ratio

ATR = Acid Test Ratio

Since the variables are correlated it is not readily possible to assess the importance of an individual variable. The contribution of an individual variable is thus better expressed by examining the correlation

between the value of Dstand and the values of the original variables. This identifies the pooled within-groups correlations between the discriminating variables and canonical discriminant functions and they are shown in Table 8.3. In short, the higher the correlation between the value of Dstand and the individual ratio the more reliable the ratio is as a discriminator.

The subjective cut-off line has been drawn where the size of correlation drops below 0.4. It is significant that the early indications point towards the ratios that involve profit, both Altman's **Profit before tax:Total gross Assets** and Taffler's **Profit before tax:Current Liabilities** show the highest correlation, along with Beaver's **Cashflow:Total debt.** Clearly, therefore, the major discriminators would appear to be the ability to sustain profit generation and hence maintain a liquidity level to meet payments as they fall due. (Dev 1974) However, the Altman **retained profit:total assets** has been deliberately bold printed since it occurs high on the list in subsequent analyses.

All the perceived successful/non-failure companies were correctly classified, but two of the expected failures were classified as successes. Disprob 1 and Disprob 2

indicate the probability that the particular company should be classified either as a failure or a success (Table 8.4). It should be emphasised that there is no traditional Altman/Taffler cut-off point. Rather, the analysis assumes a mean of 0, and discriminates on the basis of distance from the mean. That the company has been correctly classified is shown by the probability scores. Thus from Table 8.4 Adam Leisure "scored" 2.9, which is subtantially more than the mean of zero. Such a score indicates that the company is 99.8% likely to be a failure.

Table 8.4 Summary of the the Known Failure Results 1985

Company	Disc/Scor	Disprob 1 Fail	Disprob 2 Success
Adam Leis/HL	2.900	0.998	.001
Castle GB	3.336	1.000	.000
Promotions/GR	**0.920**	**0.174**	**.826**
Ecobric	4.391	1.000	.000
Imtel	4.252	1.000	.000
Metal Sc	2.717	0.996	.004
Mnemos	7.206	1.000	.000
Xyllyx	3.675	1.000	.000
Access Sat	**0.433**	**0.029**	**.971**
B I Airways	3.384	1.000	.000
Godwin Warren	-0.189	0.002	.998

Note: **Bold** print emphasises the three misclassifications.

Of the eleven expected failures, 8 were correctly

classified as exhibiting the characteristics of companies that had failed in the past. Of the three apparant mis-classifications, Promotions House was within 12 months of having the quotation cancelled, having re-organised into the private Grassroots Limited, Access Satellite had prepared what was to be its last set of published accounts prior to a long running and almost bizarre saga leading to the quotation eventually being cancelled in 1988 and Godwin Warren was showing as a successful company. It eventually failed in 1989. That British Island Airways was shown as a potential failure in the year before entering the listings vindicates the Hutchinson, Meric, Meric (1988) viewpoint about entry to the market being conducive to eventual success, but also points to excessive euphoria being evident in the market place at the time. It should be recalled that 1985 was the year, when along with 1984, the most (i.e 98) companies entered the USM listings. Such a situation begs the question if British Island Airways was too attractively priced when it came to the market in 1986. Indeed, British Island Airways was mis-classified as a long term success in every year reviewed. USM New Issue price behaviour has been the subject of a University of Aston study by Buckland and Davis.(1988)

Implications for the Other Review Years

Having looked at 1985 in some detail, emphasis needs to

be focussed on the other years. Table 8.5 summarises the results for the other years showing in particular the most significant discriminant ratio. From the table below, the over-riding indication is that apart from 1983, the ability to generate profit and hence cashflow to meet liabilities was the strongest discriminator

Table 8.5 Summary of Results for Other Years

	Eigenvalue	Canonical Correlation	Wilks' Lambda	Chi squared	DF	Significance (p)
1983	1.227	0.7422	0.4491	34.02	13	0.0012
1984	1.563	0.7809	0.3902	45.64	13	0.000
1985	2.431	0.8417	0.2915	59.79	13	0.000
1986	1.838	0.8407	0.3524	51.63	11	0.000
1987	1.391	0.7627	0.4183	37.91	13	0.0003

Pooled within group correlation between discriminating variables and canonical discriminant functions

Year		1983	1984	1985	1986	1987
Function	Ratio					
Taffler	16	0.426				
Altman	14	0.582				0.569*
Altman	33		0.549	0.524	0.412	0.674
Taffler	53		0.505	0.448		0.523*
Beaver	CFD			0.444		0.477*
Beaver	DA					0.553

Notes: Omissions indicate results for that year was below 0.4, and the asterisk (*) indicates that an even higher figure was recorded when the "at risk" element was introduced.

among the ratios tested, with the Altman **Profit:Total Assets** appearing to be the most consistent.

Introducing the "At Risk" element

The introduction of an "at risk" element evaluates the second aspect of discriminant analysis i.e predicting a group membership where the situation is currently

Table 8.6 Summary of Results - "At Risk" Group Included

	Eigen value	Canonical Correlation	Wilkes Lambda	Chi Squared	DF	Significance (p)
Func 1	1.924	0.738	0.328	72.411	26	0.000
Func 2	0.389	0.530	0.720	21.386	12	0.045

Pooled-within-Groups Correlations between Discriminating variables and canonical discriminant functions

Ratio	Function 1	Function 2
ALT33*	**0.515**	0.337
ALT14	**0.426**	
TAFF53	0.373	
BEAVECFD	0.349	
ALT12		**0.459**
TAFF16		**0.432**
ATR		0.331

*Note: ALT33 identifies the independent variable (e.g. Profit:Total Assets and the coefficient.

Bold print indicates the highest correlations and the gaps indicate values that are too low to be significant. Such values are omitted for reasons of clarity.

undetermined. The results are summarised in Tables 8.6 and 8.7. By definition, the companies are those where the conclusions might be somewhat equivocal and the statistical data will inevitably reflect the hypothesis. As intimated above, the presence of thre groups, successful, "at risk" and fail, creates two equations and two discriminant functions.

As with the success/failure analysis above, the analysis does not assign a Z-score as such. Rather, it produces a value which is appraised in terms of its proximity to 0. On the basis of the values, probabilities are assigned to the classification. Tables 8.7-8 illustrate this for the deemed failures

Table 8.7 Summary of Results for the Known Failures

Company	DiscScor1	DiscScor2	Disprob1 Failure	Disprob2 Success	Disprob3 "AtRisk"
AdamL/HL	-0.728	-0.775	0.774	0.033	0.192
CastleGB	-1.713	-0.445	0.670	0.078	0.252
Promotio	**-0.163**	**0.722**	**0.045**	**0.762**	**0.194**
Ecobric	-3.669	0.886	0.999	0.000	0.001
Imtec	-3.908	0.518	0.999	0.000	0.000
Metal Sc	-2.543	-0.571	0.945	0.008	0.047
Mnemos	-6.164	1.497	1.000	0.000	0.000
Xyllyx	-3.219	-1.370	0.974	0.001	0.026
AccessSt	**0.582**	**1.223**	**0.005**	**0.920**	**0.074**
B I Air	-3.628	1.533	1.000	0.000	0.000
G Warren	0.010	-0.037	0.199	0.578	0.401

and the companies identified as possibly "at risk." As in Table 8.4, there are two companies which are unequivocally classified as possible successes. However, the probability has dropped slightly. More interesting is Goodwin Warren. In Table 8.4, the company was classified with 99.8% certainty as a success, now there is less certainty, with success down to 57.8% probability, but a 40.1% in the "at risk"

Table 8.8 Summary of Results for Identified "At Risk" Group

Company	DisScor1	DisScor2	DisProb1 Failure	DisProb2 Success	DisProb3 "At Risk"
BioIsolat	-0.654	-2.050	0.015	0.050	0.935
Entertain	0.261	-1.535	0.002	0.157	0.840
Greenwich	-0.772	-2.932	0.006	0.014	0.980
Pineapple	0.220	-2.185	0.001	0.066	0.933
PML	-0.016	0.048	0.022	0.603	0.375
Britannia	0.189	-1.801	0.002	0.109	0.889
M/Beacon	0.583	-0.068	0.002	0.436	0.561
Microfoc	-0.274	-0.580	0.030	0.347	0.622
Oceonics	-0.363	-0.248	0.050	0.440	0.510
A Nordic	0.015	-0.868	0.010	0.298	0.691
Air Call	-0.419	-1.421	0.017	0.129	0.853
Humbersid	0.540	-2.236	0.000	0.072	0.926
WmMLincol	-3.066	0.136	0.994	0.002	0.004
Crown	1.218	-3.511	0.001	0.017	0.982
JMD	2.685	1.414	0.000	0.981	0.019
Thorpac	0.266	-0.414	0.010	0.486	0.504

category.

As would be expected, 8 of the 16 companies are unequivocally (i.e. >80%) classified as being "at risk". A further 6 are identified as being within the equivalent of the Altman "grey area", fairly high probabilities of being successful or "at risk". One, Wm Morris/Lincoln House is identified as 99.4% a potential failure, while John Michael/JMD is 98.1% correctly classified as a success. Of the expected perceived successes, one was classified as a failure, (Blanchards), while seven were classified as being potentially "at risk."

The results remain highly significant, with the pooled within groups correlations showing a particularly interesting pattern. On Function 1, where the over 75% of the variance is explained, the profit/cashflow generation based ratios remain the dominant ratios and correlate well with the standardised canonical discriminant function. However, it should be noted that it is the asset based Altman ratio that retains the strongest correlation, rather than the profit/cashflow based ratios of Taffler/Beaver/Zimmer. The main change from the straight discrimination between success/failure above being the appearance higher up the rankings of the Altman **Retained Earnings:Total Gross Assets** ratio. This again emphasises the element

of longevity in the companies under analysis. By definition, the requirement of the listings would indicate that an acceptable level of profitability and hence retained earnings would place such a ratio high on the list. However, on Function 2, apart from Altman's **Profit before Tax:Gross Assets** retaining a slightly higher ranking than the Acid Test Ratio, which in turn is only just in front of the Taffler profit based ratio, the emphasis shifts from profit and cashflow to what might euphemistically described as balance sheet strengths. The three ratios cited in the Table 8.7 above are Altman's **Gross Working Capital:Total Gross Assets,** Taffler's **No Credit Interval** and the classic **Acid Test Ratio.** That such ratios should correlate with the standardised discriminant function points to a vindication of the Tamari (1978) view that events such as slow inventory turnover, increased debtors from an aggressive sales to survive strategy, and withdrawal of credit facilities may obscure the true picture of a corporations' long potential survival. This may also tend to confirm the Houghton and Woodliff (1987) view, that the classic liquidity ratios correlate highly with success, but significantly less well with failures.

<u>Implications for the Broader View</u>

On the broader view over the five year period, the

results appear as in Tables 8.9 and 8.10. The 1985 discrimination data are in Table 8.6.

As before, the results are highly significant, with the over-riding indication is that, although the pattern in Table 8.9 is slightly more erratic, apart from 1983, the ability to generate profit and hence cashflow to meet liabilities was consistently the strongest discriminator among the ratios tested. (Shown in **bold** in Table 8.10) It is also noteworthy that the Altman/Taffler profit based ratios were more consistent and with stronger correlations than the Beaver **Cashflow:Total Debt** ratio. Only in 1987 were both the profit based ratios and the Beaver ratio significant discriminators. Indeed, 1987 had the strongest pattern of discriminating data, with liquidity ratios also showing up well. In regard to the Altman retained profit ratio, this is an inherent ratio, since the companies are required to have been in existence for some time, and thus built up reserves prior to entering the Listings. Thus a failure to generate profits and hence an ability to build up reserves would make this ratio a good discriminator, but likely to prevent entry to the listings, and as such becomes secondary to the primary ability to generate profit and cash. This may help to explain why this ratio only appeared as a significant discriminator in 1983.

Table 8.9 Discrimination between Success/"At Risk"/Failure

	1983		1984		1986		1987	
Function	1	2	1	2	1	2	1	2
Eigenvalue	1.10	0.56	1.16	0.35	1.20	0.40	1.57	0.20
% of variance	66.22	33.78	76.78	23.22	74.85	25.15	88.54	11.50
Canonical correlation	0.72	0.60	0.73	0.51	0.74	0.53	0.78	0.41
Wilks' Lambda	0.30	0.64	0.34	0.74	0.32	0.71	0.32	0.83
Chi-square	65.4	24.4	66.37	18.64	71.20	21.41	64.26	10.5
DF	26	12	26	12	26	12	26	12
Significance	0.00	0.02	0.00	0.09	0.00	0.04	0.00	0.50

Table 8.10 Pooled within-group correlations between Discriminating Variables and Canonical Discriminant Functions

Year	1983	1984	1985	1986	1987
Function 1					
Ratio					
Altman 33		**0.602**	**0.515**	-0.432	**0.595**
Taffler 53		0.457	0.373	**0.501**	**0.742**
Beaver CFD			0.350		**0.684**
Altman 14	**0.582**	0.362	0.426		0.366
Beaver D/A					-0.461
Altman 10		0.394			
Function 2					
Altman 14				0.367	
Beaver D/A					0.424
Acid Test					-0.645
Taffler 16			0.432		-0.586
Altman 12		0.568	0.459		
Current Ratio				-0.561	
Taffler 18				-0.541	
Taffler 53			**0.502**		
Beaver CF/D		0.342	0.4840		

Implcations for Theory

From the Robertson,Lau and Gentry views, it becomes pertinent to see how the most important discriminating ratios comply with any attempts at defining theorey. Table 8.11 identifies the ratios that relate closest to

the theoretical notions of declining trading stability, reduced profits moving into losses, declining working capital and increased borrowing. This involves the ratios that include turnover, profit, working capital and debt. The ratios are shown in their rank order from the SPSS print-out. The first ranking refers to the discrimination between success and failure, the second to when the "At Risk" element is introduced.

From the analysis, it is clear that the most effective discriminating ratios are still those based on the ability to generate profit and hence cash. It would appear that working capital measures are erratic, vindicating Tamari's 1978 view, and debt based measures

Table 8.11 Theoretically good discriminating ratios

Ratio/Year	1983		1984		1985		1986		1987	
Altman										
Working Capital / Total Assets	7	2	11	10	7	5	13	11	13	7
Profit:Total Assets	4	8	1	1	1	1	1	1	1	3
Taffler										
Profit / Current Liabilities	5	10	2	2	2	3	2	5	4	1
Working Capital / Total Debt	10	13	4	5	8	9	5	4	9	13
Beaver										
Cashflow:Debt	6	12	8	11	3	4	3	6	5	2
Debt:Assets	9	3	13	13	10	11	6	2	3	4

seem to be most effective when combined with the profit/cashflow rather than asset cover. It is

noteworthy that Taffler's famous **No credit interval**, and the traditional acid test and current ratios are are still not regarded as good discriminators or indicators.

Comments on the Results

It is now necessary to consider how successful the discrimination analysis was. E in Table 8.12 below represents the Expectation, based on the data from Table 8.2 above. O are the Observed results, O1 standing for the results based on the straightforward classification of success/fail, and O2 introducing the component of an "At Risk" category. Overall, straightforward discrimination between successes and

Table 8.12 Summary of the Discriminations

Year	1983			1984			1985			1986			1987		
Success	E#	O1	O2	E	O1	O2	E	O1	O2	E	O1	O2	E	O1	O2
Grad.Cos	32	31	26	33	33	27	33	33	27	33	31	30	33	33	31
Nongrad	12	12	11	14	13	13	14	14	12	14	14	14	14	14	13
Failed	7	6	5	11	9	6	11	8	8	9	7	6	5	4	4
At risk	13	*	11	14	*	14	16	*	13	16	*	12	14	*	7
Σn	64	49	53	72	55	60	74	55	60	72	52	62	66	51	55
Accuracy %		96	83		94	83		95	81		93	86		98	83

μO1 = 95.2% μO2 = 85.2%

Notes:
* Indicates that there was no perceived "At Risk" category in the analysis.

# Indicates E = Expected score, O1 = Observed score based on success/failure analysis, O2 = Observed score based on success/failure/"at risk" analysis.

failures, with no perceived "At Risk" companies, the overall correct classification averaged 95.2%. There was little evidence that the more recent data produced better classifications. After introducing the "At Risk" element, the overall average dropped to 85.2%. Again, there was no perceptible improvement in accuracy over time.

Comparison with Established Models

The table above indicates a high degree of accuracy of discrimination. To assess how successful the analysis is compared with the standard Taffler and Altman models, the results obtained in chapters 5, 6 and 7 above need to be compared. This requires comparing the results in the table above with the successful discriminations in each of the categories. However, to be consistent, the Z-score results for the same companies must be compared. Thus Table 8.13 takes the Graduates that were selected for the discriminant analysis and compares the O1 and O2 observed scores against Expectation with the Taffler 0.3 and 0.2 cut-offs and the Altman 2.9 and 2.7. Tables 8.14-15 similarly summarise results for the Non-graduates and the Failures.

The basis of assessment is to consider Altman against the O2 Observations, since Altman has a "grey" or "at risk" area. In contrast, Taffler has no identifiable

Table 8.13 Comparison for the Graduates

Year	From SPSS Observations					Taffler Cut off levels					Altman Cut off levels				
	E	O1	%	O2	%	Σn	0.3	%	0.2	%	Σn	2.9	%	2.7	%
1983	32	31	97	26	81	32	26	81	30	94	32	27	84	28	88
1984	33	33	100	27	82	33	28	85	32	97	33	32	97	33	100
1985	33	33	100	27	82	33	31	94	32	97	33	33	100	33	100
1986	33	31	94	30	91	33	30	91	33	100	33	32	97	33	100
1987	33	33	100	31	94	33	32	97	33	100	33	33	100	33	100
μ%			98		86			90		98			96		98

"grey" area, and as such, should be compared with the O1 observations. The results show that the analysis has a higher percentage of accuracy in terms of classifying successful Graduates than the Taffler model when the cut-off is taken at 0.3, but the the percentage of correct classifications equalises if 0.2 is regarded as the cut-off. By contrast, when the Altman scores are compared, the O2 observations are ostensibly not as reliable as either of the Altman cut-off indicators. This pattern appears to be consistent over the period under review.

Turning to the Non-graduate data, it must first be reiterated that a Non-graduate company is still a success, but it may not be as successful as those that have graduated. The observations from Table 8.14 when compared with the Taffler scores for the same companies

revealed that the analysis was more reliable if the Taffler cut-off was regarded as 0.3, but if the 1983 0.2 cut-off was used, then the results were almost the same over the five year period. If nothing else, this would seem to confirm the Taffler cut-off at 0.2. By contrast, the Altman model seemed to be consistently more reliable than the observed discriminant analysis results.

Table 8.13 Discriminant Analysis and the Non-graduates

Year	From 8.10					Taffler					Altman				
	E	01	%	02	%	Σn	0.3	%	0.2	%	Σn	2.9	%	2.7	%
1983	12	12	100	11	92	12	8	67	11	92	12	11	92	11	92
1984	14	13	93	13	93	14	12	86	14	100	14	14	100	14	100
1985	14	14	100	12	86	14	13	93	14	100	14	14	100	14	100
1986	14	14	100	14	100	14	14	100	14	100	14	14	100	14	100
1987	14	14	100	13	93	14	13	93	14	100	14	14	100	14	100
μ%			99		93			88		98			98		98

Since the object of this exercise was to assess the potential for forecasting failures and it was noted in chapter 6 above that the pattern of results for the Non-graduates was more erratic, the comparison of the scores will be a little difficult. The discriminant analysis has taken known successes, i.e with consistent profitability and growth. Not many satisfy that criterion, but those that do, are correctly classified. On the basis of known successes, and the lower cut-off, the Taffler model is little better than the analysis,

while the Altman models appears to perform slightly better than the analysis. However, it can be argued that both models appear to be able to classify correctly with a reasonable degree of accuracy although accuracy is improved if the population consists of stable rather than erratic performing companies. Such a conclusion may vindicate the use of the Bar-niv and Raveh approach to improved scores, since it eliminates or at least reduces the fringe area where companies could fall into differing classification groups in successive years.

In the case of the "at risk" group and the failures, the two groups were analysed to see how this approach classified the companies. Table 8.15 shows the results obtained for the 15 of the 20 failures identified in chapter 7. This group consists of a number of both failures and "at risk". For each year, column 1 identifies success or failure, and column 2 success, failure or "at risk". Since the assumption is that the company is a failure, an entry in that column indicates a mis-classification.

The results show a correct classification of potential failure or seriously at risk on average over 80% of the time. This compares well with the 70-75% shown by the Altman and Taffler modles in Table 7.3. Additionally, the warnings come on average about 3 years before the

final coup de grace. When compared with Table 7.4, Altman has 17.6% failures receiving around 3 years warning, and Taffler a mere 6.7%. Ostensibly, therefore, this discriminatn approach, with its emphasis on poor profit and cash generation performance, and within the confines of a very small

Table 8.15 The Failures - Classification and Length of Warning

Company	Date of Deletion Year	Classification and Warning Length: 1983 1	1983 2	1984 1	1984 2	1985 1	1985 2	1986 1	1986 2	1987 1	1987 2	Years
Adam Leis	1987		S							N	N	2-3
Castle GB	1987			S	R					N	N	2-3
Prmotion GR	1986				R	S	S					None
Access Sat	1988				R	S	S	N	N	N	N	None
Ecobric	1988	N	N		R				R			4
Imtec		S	S									*
Metal Sc	1988	N	N							N	N	2-3
Mnemos	1989	N	N							N	N	2-3
Xyllyx	1985	N	N							N	N	2-3
B I Airways	1990	N	N	N	N			S	S	S	S	<2
Goodwin Warr	1989			S	S	S	S					<2
Pineapple	1989		R		R		R		R			3-4
Anglo Nordic	1988	N	N		S		R		R			2-3
Humber/Audit	1989		R		R		R		R			4-5
Wm Morris LH	1988	N	N		R		R					3-4
Σn		12		24		26		24		14		
% correctly classified (μ = 82.6%)		75		87.5		73.1		91.7		85.7		

Key: S = misclassified success, N = no data, R = "At Risk"

sample, may prove to be a slightly better method for predicting future corporate events. However, as this is an in sample test it may not perform as well on out of sample data from future failures.

Table 8.16 The "At Risk" Group - Classification Results

Company	Subsequent Event	Year 1983	1984	1985	1986	1987
Airship Industries	Cancelled 1984	F	F	N	N	N (Finally failed 1990.)
Camotech	Cancelled 1987	N	N	N	S	N
Bio-Isolat	S52*	R	R	R	R	R
Entertain	S56*	R	R	R	R	R
Greenwch	S57*	R	R	R	S	R
PML	Reorgan 87	N	S	S	F	N
Britannia	G4*	S	R	R	S	S
Mellerware (G9)*	Renamed Beacon 87	S	S	R	R	R
Microfocus	G11*	R	N	R	R	R
Oceonic	G14*	R	S	R	R	R
Air Call	Acquired86	R	S	R	R	N
Crown	Reorgan 88	R	R	R	R	R
Healthcare	Reorgan 84	R	N	N	N	N
JohnMichael	Reorgan 88	N	N	S	S	S
Thorpac	Reorgan 88	R	R	R	R	S

Source KPMG Peat Marwick McLintock USM Quarterly Survey September 1989

Note* Indicates company analysed as either Graduate (G) or Non-graduate (S) with a poor Z-score pattern.

Key F = Failed N = No data R = At Risk

Turning to the "At risk" group the details are listed in Table 8.16. Here the analysis correctly identifies a group of companies that can be perceived to be at risk, and in Altman terminology, likely to score between 1.8 and 2.7. The failure of Airship Industries, which had withdrawn to the Third Market, was correctly predicted. The need for some form of fairly drastic management attention, as suggested by Argenti, was again correctly predicted in a further five companies. It is too soon in the case of four of them to see how successful these re-organisations have been. The acquisition of Air Call in 1986 would suggest that it was a rescue. However, there remains a small hard core of USM companies, of which four are Graduates, that remain solidly entrenched in the "At risk" category. That two of the Non-graduates are from the Leisure sector, and the Graduates are all from the Electricals may be significant, but further analysis over a much longer period may be required.

Two final comments are required. The first is in relation to how subsequent events have affected four of the Graduate companies selected for the discriminant analysis. In the light of recent events, (Spring 1989 and Summer 1990) two Non-graduates have been added to the list. Using data from the discriminant analysis descibed above, the results are summarised in Table

Table 8.17 Post Analysis Period "Failures"

Company	Year 1983 1	2	1984 1	2	1985 1	2	1986 1	2	1987 1	2	Event
Federated Housing	S	R	S	S	S	S	S	S	S	S	Receivers 90
Blanchards	S	S	S	S	S	F	S	S	S	S	Suspended 89
Parkfield	S	S	S	R	S	S	S	S	S	F	Receivers 90
Michael Peters	S	R	S	S	S	S	S	S	S	S	Administrator 1990
Yellowhammer	S	S	S	S	S	S	S	S	S	S	Receiver/ Rescue 1990
Midsummer Leisure	S	S	S	R	R	R	S	S	S	S	Under threat 1990

Note: S = Success R = "At Risk" F = Failure

8.17 above.

Apart from 1983, which could be attributed to the youth of the company and not having had a full year's advantages of being listed, Federated Housing gave no warning in its accounts until the last two years, and then it was stock turnover, that there was any sign of serious trouble. It is thus likely that the Edminster model (1972) may have identified the problem earlier. Equally, Midsummer Leisure, apart from the period of uncertainty during the mid 1980s gave no indication of the problems looming in 1989-1990. In the case of Yellowhammer, where problems did not begin to emerge until mid-1989, there was no indicator in 1987, which would have increased the length of warning to between two and three years. Interestingly enough, the 1989/90

interim results exhibited increased turnover, but a loss and a passing of the interim dividend. Michael Peters exhibits doubts when the "at risk" companies are introduced into the analysis for 1983. This can be explained with reference to the Hutchinson-Meric-Meric (1988) research, since the company did not enter the listings until the end of 1983. All was ostensibly well up to the end of 1987, so no 2-3 year warning could be claimed. 1988 continued a pattern of increased turnover, (up 87%) increased profit (up 83%) adequate liquidity and reserves and market confidence seemed to be holding. 1989 however, despite showing dramatically increased turnover, profit margins had halved (Robertson 1984), there was a deterioration in working capital and liquidity, and substantially increased gearing. However, the market had begun to loose confidence, since the share price trend was down from late 1988/early 1989.

Blanchards showed good Z-scores over the period 1983-87 with only 1983 Taffler close to the 1982 0.2 cut off. On the discriminant analysis only 1985 showed a likelyhood of failure which was the year the company came to the market. The first two years were ostensibly good, although the Altman score dropped in 1987, reflecting an erosion of reserves. However the 1987 profit was down. Losses were turned in for 1988 and the

dividend passed, and 1989 revealed falling turnover, losses, and deteriorating liquidity. During these last two years, the Altman score dived down to 1.5 hitting 0.0 in 1989. The Taffler score similar plunged below 0.2 in 1988. Blanchards thus exhibited an almost textbook profile of impending failure.

Parkfield is interesting from another aspect. It had already been noted that of the sample non-graduates selected, it was one of the companies that graduated after the sample had been identified. Therefore, it should have been amongst the better performers. However, it has already been shown in chapter 6 that Parkfield was a poor performer in 1983-84, and subsequently changed direction. In 1987, when the analysis has three choices, Parkfield appears as a possible failure. Curiously, with sales, profits and dividends bouyant, the symptoms that appeared in 1989 were deteriorating liquidity (Quick ratio down from 0.93:1 in 1988 to 0.66:1 in 1989) despite an almost 9% increase in debtors turnover, a substantial increase in gearing from 8% to 51% and a deterioration in the Beaver cashflow/total debt ratio from 26% to 15%.

The second comment refers to the Altman **Market Price:Total Debt** ratio. Clearly, market price is a measure of confidence and hence a reflection on the

views of the market on a corporation's long term future. Table 8.18 shows, however, that this is a very poor discriminator between success, "at risk" and failure. In view of the claims made (Ahorany et al 1980, and Westerfield 1970) about the Z-scores and discriminate analysis being unable to out perform the market, this is exceptionally interesting and may prove a useful area for future research. This will be particularly interesting in the current uncertain political climate with depressed stock markets and many non-graduate USM companies showing share prices close to par value if not below.

Table 8.17 Pooled-within-group Correlations between discriminating variables and canonical discriminant functions

Ratio: Altman's Market Price:Total Debt					
Year	1983	1984	1985	1986	1987
Success/ Failure	-.041	-.184	-.034	0.640	0.254
Success/ At Risk/ Failure					
Function 1	.246	-.198	0.045	-.050	0.072
Function 2	-.269	0.138	0.136	-.292	-.306

The change in the economic climate coupled to depressed stock markets, may produce more failures at extremely short notice, and distortions in classification, despite the low weighting given by Altman to this ratio. The overall impact of this can only be assessed by research similar to undertaken by Tamari (1964, 1970, 1971, 1978) and Inman (1988) where different

economic conditions and share price ranges were the background to the research. It may be that the companies identified are the type that might have failed anyway, and the economic climate may influence the number of failures and the pattern of length of warning.

Concluding Remarks

This approach to discriminant analysis successfully classifies successful companies. It would appear that the success rate with both the Graduates and the Non-graduates is comparable to the Taffler results especially when the 1982 0.2 cut-off is selected. However, it would appear that the Altman model retains its edge over this approach to discriminant analysis. However, the companies selected were well established and had consistent rates of performance, and it is likely that samples containing more erratic performers may have produced less conclusive results. This would suggest that companies that are new to the listings, or perhaps inherently entrepreneurial, may not readily lend themselves to the traditional MDA approach, which may give more reliable results when based on more established companies. Clearly, Altman himself recognized this and developed modified forms of his original model. (1971, 1983) As to the failures, the approach was marginally more successful, with perhaps

slightly earlier warnings. However, any conclusions about failure prediction must consider the smallness of sample size, economic and market climate and the inherent culture of the business. A grey area can be indentified which could be used to indicate the need for drastic management action, but here the potential problems might be that management may have already responded to internal information, or that it is too late anyway.

While it is clear that the procedure classifies companies with a high degree of accuracy, in the light of recent events, it will be necessary to test the stability of the analysis, by taking an out of sample analysis to see if the classifications are still as accurate.

As to confirming any theory as such, it is significant that in general, none of the sales, working capital/liquidity or gearing ratios provided a consistent pattern for discriminating between successes and failures. Such results suggest that while such trends may be part of the prognosis as to the nature of a corporate future, the ability to generate profit, in order to increase corporate wealth and hence growth, as well as pay creditors when they fall due is the key element of survival.

CHAPTER 9 CONCLUSION AND POINTERS TO FURTHER RESEARCH

Verdict on the Traditional Models

From the research reported in chapters 5-7, it can be concluded that the traditional Z-score models of Altman and Taffler still have a value in the classifying of corporations between potential on-going corporate successes and failures. The evidence indicates that while the models were developed in somewhat different conditions and with a different mix of corporations, they can be reasonably applied to the classic USM type of company. This in part answers the criticism that Z-score models cannot be universally applied. Rather, the initial overall conclusion must be that both scores classify corporations successfully overall with a high (>80%) degree of accuracy. Indeed, it should be emphasised that Altman in particular has stood up well in comparison to more recent discriminant analysis. However, the success level is higher with successful corporations than with potential failures. In that, the conclusions must be similar to those of Houghton and Woodliff (1987) in respect of the traditional "quick ratio."

Two criticisms may be at least considered.

First, that the Non-graduates produced a slightly more erratic pattern of results, suggesting possibly that the revised model, more in keeping with unlisted or

private company, might be more reliable. Secondly, certain sectors, notably Leisure, may not lend themselves quite so readily to traditional Z-score analysis. However, when it comes to considering failures, while the classification success rate was high, the length of warning is, at best, inadequate. This is reinforced by the information in Table 8.17 which shows the failures that occurred during the summer of 1990. None of the companies had any real indication of the impending trouble in 1986-87. This tends to imply that the warnings are well below the 2 or 3 years originally claimed by early researchers. Thus the initial conclusions must be that the models are robust and acceptably reliable in the context of the USM companies, but the criticisms about length of warning expressed in the literature have been upheld.

Implications for the Use of Discriminant Analysis

The use of discriminant analysis to see if there were single or a group of particularly useful ratios that could be employed revealed results that were little better than the traditional Z-score models. Altman's models retained marginally better classification results than the ratios used in the discriminant analysis. However, it was found that the ability to generate cash through profits was consistently the most effective discriminating ratio, closely followed by the

Altman's **retained earnings:gross assets.** This tended to vindicate the original Beaver (1967) view and confirm the almost obvious point that survival and growth depends upon the ability to generate profit and cash to sustain the increase in corporate wealth. The Altman ratio is probably inherent, in that to reach the stage where a company is admitted to the Listings requires several years of successful trading and hence reserves should have been built up. The discriminate analysis was marginally more successful in discriminating between potential successes and failures, and gave slightly earlier warnings.

In regards to the other measures suggested by Robertson, Lau and Gentry, the results produced from sales, working capital and debt based ratios were all too erratic to be taken as effective discriminants. It was particularly noted that the Altman's share price based ratio was a very poor discriminator, and this may call into question any Stock Market based methods of prediction. If, as has been suggested, the Market has already identified and marked down a perceived "at risk" company, then this ratio ought to be more reliable a discriminator.

Contributions to Theory

This research has to some extent attempted to respond

to Lev's 1974 demand for a more theoretical approach. By taking out the "youth factor" it has been possible to test a large population and in particular identify characteristics which might be symptomatic of possible future failure. However, the only economic characteristics that have been found to be useful in responding to Lev's 1974 appeal are profitablility, cashflow generation and the inherent ability to retain funds in the business to build it up. It could be argued that Lev demanded ten years, and that a ten year study of the USM companies under review might produce better results. However, such a study would show results partially distorted by the post-1987 USM doldrums and the effect of the dramatic change in the UK economic climate which has resulted in a large number of USM companies turning in large losses and showing very depressed share prices.

However, if a theoretical model is to be developed as envisaged by Lev, then the indications from the ideas suggested by Robertson (1984) and Lau (1986) along with the discriminant analysis point to a foundation based upon decline in profitability and cashflow, supported by a change in working capital rather than pure liquidity (c/f Tamari and Houghton and Woodliff 1987) and possibily the passing of the dividend.

Answer to Criticsm

Irrespective of criticsms levelled against it, MDA and the use of Z-score analysis in financial analysis is still to be found and likely to be extended. Recent research points to the use of Z-score analysis in the context of the auditors' "going-concern review" (Koh and Killough 1990) where Z-score analysis is seen as a vital tool in improving the objectivity of existing auditing guidelines and procedures in Singapore, the United States and undoubtedly the United Kingdom. (Using a propretory model imported from the United States, Stoy Hayward having been developing such procedures since the early 1980s.) Elsewhere, Barnes (1990) has used a paired sample to predict takeover targets, although an actual MDA model was not employed, rather the ratios were compared with the sector average.

Indications for further research

(i) Changing economic climate

With regard to analysis of the USM, the first priority must be to re-test the corporations in the light of the changed UK economic climate. This will indicate how stability and robustness of both the traditional Z-score models and the discriminating ratios. In view of the depressed state of the the London Stock Market and the USM in particular, (over 30% of USM companies now

valued below par value) this would be a test similar to that performed by Tamari in the 1950 and 1960s where the impact of changes in the economic climate were compared.

(ii) Stablised ratios

The research undertaken by Platt and Platt (1990) will have considerable relevance to USM type companies. The authors claim a greater stability when corporate ratios are compared with industry ratios. Prediction is thus based on whether or not a relevant ratio is drifting out of line. The nature and culture of USM companies, especially in certain specialist sectors, notably Leisure, would suggest from the results obtained that such a methodological approach will produce a less equivocal result.

(iii) The use of ß ratios

In the light of the claim that the Z-score analysis does not appear to out perform Stock Exchange predictions, suggests that another line of research might be based upon ß values and the correlation of rates of failure with the ß score. This again would in part respond to Lev, by identifying a specific economic characteristic.

(iv) Evaluate on the basis of failure

Much of the research done has been based upon comparing successful companies with failures, either by the

paired sample methodology or by taking a proportion of failures in keeping with the over proportion of failures in the market. Indications from the results are that the successes are more accurately identified, which overstates the accuracy of any prediction model. Wood and Piesse (1989) identified 24 failures in their evaluation of the information value of Z-score analysis, and since Johnson (1970) has argued that failed firms have different ratios from successful ones, a basis might be to take a large sample of failures to identify common characteristic discriminating models.

(v) Identify potential non-starters

The 1988 Buckland and Davis study emphasised the discounting of new issue share prices. The reason for any discounting is always to attract investors, and to pitch the price so that the issue will not fail. It becomes pertinent to ask if there is any correlation between the size of discount and any subsequent unhappy events.

(vi) Component sensitivity

Senstivity analysis in the context of management accounting and decision making quantifies how much a cost or revenue component is sensitive to economic change. Where ratios and scores appear erratic, this may be due to change in one or more components. In may

thus be helpful in further developing the practical use of Z-score methodology to introduce a measure of how sensitive the components are to change and hence producing a score that is above/below a critical cut-off.

Final Way Forward

Lev emphasised (1974) that effective prediction might go beyond the limits of pure accounting and financial information. Such a view is undoubtedly supported by Argenti (1976) and confirmed by the Keasey and Watson (1987) study. If the Robertson view is correct, then a theoretically based way forward may be based on a statistically developed financial based model set against a background of such non-financial/qualitative information as sales turnover and relationship to market and market share. Such an approach brings in the stabilising effect of the total market and sector performance. Certainly such an approach would find favour with auditing methodology on the appraisal of the suitability of going concern accounting procedures. However, such an approach may well require a more complicated analysis that the MDA model, possibly along the lines of logit analysis and multi-dimensional scaling suggested by Mar-Molinero and Ezzamel (1986).

The End

BIBLIOGRAPHY OF LITERATURE CITED.

Ahorany J., Jones C P., and Sway I. "An Analysis of Risk and Return Characteristics of Corporate Bankruptcy Using Capital Market Data" **The Journal of Finance** xxxv September 1980 pp 1001-1016

Altman E I "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy" **The Journal of Finance** September 1968 pp 589-609

Altman E I "Corporate Bankruptcy in America" D C Heath Lexington Mass 1971

Altman E I "Predicting Railroad Bankruptcies in America" **The Bell Journal of Economics and Management Science** iv Spring 1973 pp184-211

Altman E I et al "ZETA Analysis: A New Model to Identify Bankruptcy Risk of Corporations" **Journal of Banking and Finance** 1 June 1977 pp29-54

Altman E I "Corporate Financial Distress, A Complete Guide to Predictions, Avoiding, and Dealing with Bankruptcy" Wiley, New York 1983.

Altman E I "The Success of Business Failure Predictive Models: An International Survey" **Journal of Banking and Finance** June 1984 pp171-198

Apilado V P et al "Evaluative Techniques in Consumer Finance: Experimental Results and Policy Implications for Financial Institutions" **Journal of Financial and Quantitative Analysis** March 1974 pp275-283

Argenti J "Corporate Collapse" McGraw-Hill London 1976

Argenti J "Company failure - long-range prediction is not enough" **Accountancy** August 1977 pp46-52

Argenti J "Predicting Corporate Failure" **Accountants Digest** No 138 ICAEW London 1983

Bannock G and Doran A "Going Public: A Report on the Markets in Unlisted Securities" EIU Special Report No 224 1985

Barnes P "The Prediction of Takeover Targets in the UK by Means of MDA" **Journal of Business Finance and Accounting** xvii Spring 1990 pp73-84

Bar-niv R and Raveh A "Identifying Financial Distress: A New Nonparametric Approach" **Journal of Business**

Finance and Accounting xvi Summer 1989 pp361-383

Beaver W H "Financial ratios as predictors of failure" **Empirical Research in Accounting: Selected Studies,** supplement to **Journal of Accounting Research** Jan 1967 pp71-111

Beaver W H "Alternative Accounting Measures as predictors of Failure" **Accounting Review** Jan 1968 pp 113-22

Beaver W H "Market Prices, Financial ratios and the Prediction of Failure" **Journal of Accounting Research** vi Autumn 1968 pp179-192

Belkaoui A "Conceptual Foundations of Management Accounting" Reading (Mass) 1980

Blum M P "The Failing Company Doctrine" Ph.D dissertation, Columbia University 1969.

Blum M P "Failing Company Discriminant Analysis" **Journal of Accounting Research** xii Spring 1974 pp1-25

Booth P J "Decomposition Methods and the Prediction of Financial Failure" **Journal of Business Finance and Accounting** Spring 1983

Braganza F A "Ratios: do you know them backwards?" **Students Newsletter** July 1989 pp14-6

Buckland R and Davis E W. "The Pricing of New Issues on the USM - The Information Content of New Issue Prospects" Paper presented at the British Accounting Association Spring 1988

Cannon J G "Losses by Bad Debts" **Banker's Magazine** li 1895

Copeland R M., Ingram R W "Municpal Bond Market recognition of Pension reporting Practices" **Journal of Accounting and Public Policy** Fall 1983 pp147-165

Coshall J T., "SPSS/PC+ Multivariate Analysis" Unpublished teaching guide 1990

Cucksey J., Medland D "The USM - A Review" Robson Rhodes/Waterlow London 1984

Davis E W., and Pointon J "Finance and the Firm" Oxford 1984

Deakin E B "A Discriminant Analysis of Predictors of

Business Failure" **Journal of Accounting Research** x Spring 1972 pp167-179

Dev S "Ratio Analysis and the Prediction of Company Failure" in Edey H and Yamey B S (eds) "Debits, Credits, Finance and Profits" Sweet & Maxwell London 1974

Durand D D "Risk Elements in Consumer Installment Financing" New York National Bureau of Economic Research 1941 pp105-142

Edminster R O "An Empirical Test of Financial ratio Analysis" **Journal of Financial and Quantitative Analysis** vii 1972 pp 1477-1493

Eisenbeis R A "Pitfalls in the Application of Discriminant Analysis in Business, Finance and Economics" **Journal of Finance** xxxiii No 3 June 1977 pp875-899

Elam R "The Effects of Lease data in the Predictive Ability of Financial Ratios" **Accounting Review** January 1975 pp25-43

Fisher R A "The Use of Multiple Measurements in Taxonomic Problems" **Annals of Eugenics** No 7 September 1936 pp179-188

Fitzpatrick P J "Symptoms of Industrial Failure" Washington 1931

Fitzpatrick P J "A Comparison of the Ratios of Successful Industrial Enterprises with those of Failed Companies" Washington 1932

Foster G "Financial Statement Analysis" Princeton NJ 1986

Foulke R A "Practical Financial Statement Analysis" Princeton NJ 1968

Francis D Pitt "Liquidity Tests and Accounting Ratios" **Students Newsletter** April 1982 p2-3

Francis D Pitt "Solvency Tests and Probability Measurement" **Students Newsletter** June 1988

van Fredriklust R A I "Predictability of Corporate Failure" Nijholl 1978

Gambling T "The Accountant's Guide to the Galaxy" **Accounting Organisation and Society** x 1985 pp415-25

Gentry J A., Newbold P., Whitford D T., "Classifying Bankrupt Firms with Funds Flow Components" **Journal of Accounting Research** xxii Spring 1985 PP146-160

Gentry J A., Newbold P., Whitford D T., "Funds Flow Components, Financial Ratios and Bankruptcy" **Journal of Business Finance and Accounting** xiv Winter 1987 pp595-606

Gombola M J Ketz J E "Financial ratio Patterns in Retail and Manufacturing Organizations" **Financial Management** Summer 1983 pp 45-56

Gupta L C "Financing Ratios for Monitoring Corporate Sickness - Towards a More Systematic Approach" Oxford 1983

Gupta M C., Huefner R J. "A Cluster Analysis Study of Financial ratios and Industry Characteristics" **Journal of Accounting Research** Spring 1972 pp77-95

Hambro Company Guide 1986-1990 Published quarterly in London by Hemington-Scott.

Hambro Performance Rankings Guide Published Annually 1988-1990

Hutchinson P., Meric I. and Meric G. "The Financial Characteristics of Small Firms which achieve quotation on the UK USM" **Journal of Business Finance and Accounting** vx Spring 1988 pp9-19

Homan M "Insolvency - Spotting the Danger Signals" **Banking World** October 1984 pp33-39

Horrigan J O "Some Empirical Basis of Financial ratio Analysis" **The Accounting Review** xl July 1965 pp558-568

Houghton K A., "Accounting Data and the Prediction of Business Failure: The Setting of Priors and the Age of Data" **Journal of Accounting Research** xxii Spring 1984 pp361-368

Houghton K A., Woodliff D R "Financial Ratios: The Prediction of Corporate 'Success' and Failure" **Journal of Business Finance and Accounting** xiv Spring 1980 pp 537-554

Inman M L "Appraising Altman Z-formula prediction" **Management Accounting** lx pp37-9 November 1982

Inman M L "Crash of 1987 and the Impact on Z-scores" **Management Accounting** lxvi June 1988

Johnson C J "Ratio Analysis and the Prediction of Firm Failure" **Journal of Finance** xxv December 1970 p1168

Joy O M and Tollefson J O "On the Financial Applications of Discriminant Analysis" **Journal of Financial and Quantitative Analysis** December 1975 pp723-739

Kaplan R S., Roll R "Investor Value of Accounting Information: Some Impirical Evidence" **Journal of Business** xlv April 1972 pp225-257

Karels G V and Prakash A J "Multivariate Normality and Forecasting Busines Bankruptcy" **Journal of Business Finance and Accounting** xix Winter 1987 pp573-593

Keasey K and Watson R "Non-financial Symptoms and the Prediction of Small Company Failure: A Test of Argenti's Hypothesis" **Jounral of Business Finance and Accounting** xiv Autumn 1987 pp335-354

Kharbanda O P., Stallworthy E A "Corporate Failure Prediction, Panacea and Prevention" London 1985

Klecka W R "Discriminant Analysis" Sage 1980 pp7-70

Koh H C and Killough L N "The Use of MDA in the Assessment of the Going Concern Status of an Audit Client" **Journal of Business Finance and Accounting** xvii Spring 1990 pp179-192

Killough L N., Koh H C. and Tsiu K C "Business Failure Prediction Models An Evaluation of the Classification Techniques Used" ENDEC Research Monograph No 2 1989

KPMG Peat Marwick McLintock "USM Survey" Published April/September each year.

Kumar V "Predictive Capability of Financial Ratios - the Empirical Evidence" **ICWA India Research Bulletin** v January 1986 pp29-41

Lau A H-L "A FIve State Financial Distress Model" **Journal of Accounting Research** xxv Spring 1987 pp

Lev B "Financial Statement Analysis: A New Approach" PHI Englewood Cliffs NJ 1974

Lincoln E E "Applied Business Finance New York 1926

Marais D A J "A Method of Quantifying Companies Relative Financial Strength" **Bank of England Discussion Paper** No 4 1979

Mar-Molinero C and Ezzamel M "The Use of Multidimensional Scaling in the Analysis of Corporate Failure" Unpublished paper January 1986

Mason R J., Harris F C "Prediciting Company Failure in the Construction Industry" **Proc I Civil Eng** lxvi 1979 pp301-7

Merwin C L "Financing Small Corporations in Five Manufacturing Industries 1926-36" New York 1942

Meyer P A., Pifer H W "Prediction of Bank Failures" **The Journal of Finance** xxv September 1970 pp853-68

Miller D "Common Syndromes of Business Failure" **Business Horizons** November 1977 pp43-53

Myers H and Forgy E W "Development of Numerical Credit Evaluation Systems" **Journal of the American Statistical Association** 1 September 1963 pp797-806

Neter J "Discussion of Financial ratios as Predictors of Failure" Empirical Research in Accounting: Selected Studies 1966 Supplement to vol iv **Journal of Accounting Research**

Norgard R S "The Causes of Corporate Collapse" **Australian Accountant** April 1987 pp24-25

Ohlson J S "Financial Ratios and the Probalistic Prediction of Bankruptcy" **Journal of Accounting Research** Spring 1980 pp 109-131

Ooghe H., Verbare E "Predicting Business Failure on the basis of accounting data - the Belgain experience" **International Journal of Accounting Education and Research** xx Spring 1985 pp19-44

Parosch J and Tamari M. "Financial ratios as a means of regressional analysis" **Bank of Israel Economic Review** 1978

Peters T J., R H Waterman jnr "In Search of Excellence" New York 1982 pp13-23

Platt H D and Platt M B "Development of a Class of Stable Predictive Variables: The Case of Bankruptcy Prediction" **Journal of Business Finance and Accounting** xvii Spring 1990 pp31-52

Ramser J R., Foster L O "A Demonstration of Ratio Analysis" Bureau of Business Research, University of Illinois, Bulletin No 40 1931

Rawsley R A "A research project into the operation and development of the USM" London Business School 1984

Richardson F M and Davison L F "An Exploration into Bankruptcy Discriminant Model Sensitivity" **Journal of Business Finance and Accounting** x Summer 1983 pp195-207

Robertson J "Company Failure - Measuring changes in financial health through Ratio Analysis" **Management Accounting** November 1983 pp24-28

Robertson J "Research Directions in Financial Ratio Analysis" **Management Accounting** 1984 p30

Smith K V "Classification of Investment Securities using MDA" Institute Paper Perdue University 1965

Smith R F "A Test Analysis of Unseccessful Industrial Companies" Bureau of Business Research, University of Illinois, Bulletin No 31 1930

Smith R F and Winakor A H "Changes in the Financial Structure of Unsuccessful Corporations" Bureau of Business Research, University of Illinois, Bulletin No 51 1935.

Sudarsanam P S., Taffler R J "Methodological Issues in Financial ratio Analysis: Some Empirical Evidence" Undated Paper produced for the Association of University Teachers of Accounting

Taffler R J and Tisshaw H "Going, Going, Gone" **Accountancy** March 1977

Taffler R J "Forecasting Company Failure in the UK using Discriminant Analysis and Financial Ratio Data" **Journal of the Royal Statistical Society** Series A cxlv part 3 1982 pp342-358

Taffler R J "The assessment of company solvency and performance using a statistical model - a comparative UK-based study" **Accounting and Business Research** Autumn 1983

Taffler R J "Empirical Models for the Monitoring of UK Corporates" **Journal of Banking and Finance** 1984 pp199-227

Tamari M "Financial Ratios as a Means of Forecasting Bankruptcy" **Bank of Israel Economic Review** April 1964 pp 15-45

Tamari M "The effect of a recession on Israeli

manufacturing corporations" **Bank of Israel Economic Review** March 1970

Tamari M "The influence of economic recovery (1967-68) on Israel's industrial companies" **Bank of Israel Economic Review** March 1971

Tamari M "Financial Ratio Analysis and Prediction" Paul Elek London 1978

Tatsuoka M M., Tiedaman D V "Discriminant Analysis" **Review of Educational Research** xxiv 1954 pp402-420

Thomas J., Evanson R V "An Empirical Investigation of Association between Financial ratio use and Small Businesses" **Journal of Business Finance and Accountancy** Winter 1987 pp555-571

Wall A "Study of Credit Barometrics" **Federal Reserve Bulletin** v 1919

Wall A., Duning R W "Ratio Analysis of Financial Statements" New York 1928

Walter J E "A Discriminant Function of Earnings Price Ratio on Large Industrial Companies" **Review of Economics and Statistics** xli February 1959 pp44-52

Watts R L., Zimmerman J L "Positive Accounting Theory" PHI Englewood Cliffs NJ 1986

Westerfield R "Pre-Bankruptcy Stock Price Performance" University of Pennsylvania 1970

Wood D., and Piesse J "The Information Value of MDA Based Financial Indicators" **Journal of Business Finance and Accounting** xiv Spring 1987 pp27-38

Wood D., Piesse J "Issues in Assessing MDA Models of Corporate Failure" Paper delivered to Southern Area BAA Conference, Brighton September 1989

Zimmer I "A Lens Study of the prediction of Corporate failure by Bank Loan Officers" **Journal of Accounting Research** xviii 1980 pp629-636

Zmijewski M E "Methodological Issues related to the estimation of Financial Distress Prediction Models" **Journal of Accounting Research** 1984 pp59-82